FLIGHT
The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World
Founder and Editor: STANLEY SPOONER
A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport
OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM

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Flight

The Aircraft Engineer and Airships

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DIARY OF FORTHCOMING EVENTS.

Club Secretaries and others desirous of announcing the date of important fixtures are invited to send particulars for inclusion in the following list:

April 7 ...	Lecture by Mr. J. L. Cope, "Aerial Survey in the Antarctic," at Central Hall, Westminster, 8 p.m.
April 18 to May 2	Seaplane Competition at Monaco
May 22 and 23	Aviation Competition at Juvisy in connection with Fêtes de Paris
June 1 ...	Air Ministry Competition (Small Type Aeroplanes), Martlesham Heath
July ...	S.B.A.C. International Aero Exhibition at Olympia
July (mid.)	Seaplane Contests at Antwerp
Aug. 1 ...	Air Ministry Competition (Seaplanes), Felixstowe
Aug. (end of)	Schneider International Race, Venice.
Sept. 1 ...	Air Ministry Competition (Large Type Aeroplanes), Martlesham Heath
Sept. (end of)	Gordon-Bennett Aviation Cup, France.

EDITORIAL COMMENT

IN connection with the County of London Cadet Force, a most admirable scheme of education in aircraft construction has been initiated. Three instructional wings have been started—one at St. Pancras, one at Hackney, and a third at Woolwich. On the recommendation of their officers, boys are entered for a six months' course of theoretical and practical aeronautical instruction. Naturally, the boys are very keen on the work, in which they seem to take the greatest possible interest. The scheme has the active support of the Air Ministry, and we understand that several of the largest of the constructor firms are taking a great interest in it, and have assisted by gifts of plant and engines. Similar assistance has also been afforded by the Air Ministry. In addition, visits are to be made from time to time to the factories with a view of demonstrating to the pupils the manner in which the knowledge which is being imparted to them is put into actual practice in the construction of machines. Incidentally, it is worth remarking that all the instructors are ex-officers and non-commissioned officers of the R.A.F.

Aeroplane Schools for Boy Cadets

Anything better in its way than this most practical scheme of interesting and teaching the rising generation the elements of aircraft construction cannot be imagined and the example set by the County of London Cadet Force authorities it would be difficult to imagine. We do not know at the moment how far the course of study is intended to go, but we assume that the most apt and interested pupils will be taken quite a long way in the theory and technique of aircraft design and construction. The farther the better, because with the technical staffs of the factories being distributed to the four winds, as is happening now, in the years to come we shall want all the trained men and youths available. Undoubtedly the example now set is worthy of being followed by others and we trust that Cadet Corps executives all over the country will go carefully into the possibility of starting similar classes. We quite appreciate that there will not be room in the aircraft factories for all the boys who will desire to learn about the manner

in which aeroplanes are designed and constructed, but we do not imagine that all of them will take up the courses with a view to making a profession of their knowledge, and from this point of view alone it will be well if the move is widely followed, for the reason "that it is quite essential that popular interest in aviation and all connected with it should be fostered."

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"Aerial Transport" Mr. Holt Thomas's recently-published book on "Aerial Transport" comes at an opportune moment. The future of British commercial aviation is very much a matter of speculation at the moment and is a cause of no little anxiety to those most intimately identified with it and who have at heart the maintenance of the aerial supremacy so hardly won in the War. Naturally, the author approaches his subject as one who has an abiding faith in the future of aviation, if only the necessary aid is forthcoming to see the industry through the transient troubles that beset it in this period of reconstruction. He holds that a nation which once secures definite supremacy in the air will be able to maintain it—a fact that the lessons of the War seem to have driven home to the hilt, if those in power would see it and base their policy upon it. He further believes—and we believe with him—that to this Empire the maintenance of a supreme Air Force is of vital importance and even of greater moment than the Army or the Navy. No doubt this is controversial ground and his conclusions in this respect will in all probability bring down a storm of criticism on his head, in like manner to when in the past we were bold enough to make the same statement, but that is the fate of all advocates of new causes or of causes which are but imperfectly understood by the majority. That he is right we are convinced and that the world will think with him and us in a very few years we are equally certain.

Not the least interesting part of the book is the Introduction, written by Lord Northcliffe, who has been a sincere friend to aviation since its infancy. It is not the less interesting when we remember the long vision with which Lord Northcliffe has regarded the movement and of how unfailingly right he has been in his views. It is old history now of how, when he offered the £10,000 prize for the first flight from London to Manchester, the newspapers almost with one voice said quite plainly that this was merely an advertising "stunt" and that Lord Northcliffe and his advisers knew very well the prize would never be claimed. They were wrong and he was right as we know. Then, the same sort of thing, though in a more subdued key, was said about his offer of a similar prize for a direct flight across the Atlantic. Again his prevision was perfectly right, and the critics were once again confounded. His record, therefore, is such that when he ventures into prophecy regarding aerial transport his words command respect as those of one of the best informed laymen of our time.

In his introduction, Lord Northcliffe scouts the idea that the airship and the aeroplane are, as some would have us believe, at the same stage of development as Stephenson's earlier locomotive, and says that he takes a much more sanguine view. Apart from the carriage of passengers, mails and goods, there are many minor and unexpected and suggestive uses to which the aeroplane or flying boat is being applied, such as surveying and exploring. Accurate photographs are being taken from the air of forests, showing the exact nature of the timber therein, a task that has hitherto required the prolonged and often dangerous services of men on foot. Seas can be scoured for approaching shoals of fish, and thus greatly increasing the capture of sea food. Unknown lands can be opened up—the possibilities of aerial transport are but little visualised as yet. Lord Northcliffe concludes:

"The diminishing number of critics of commercial flying should remember that at the time of writing most of our efforts are semi-experimental. To suggest that airship and aeroplane are as little advanced as Stephenson's "Rocket" is to belie facts. Our hope of the future lies in the fact that Great Britain and her associate nations—Australia, Canada, New Zealand, South Africa and India—have in their services the best flying men in the world, who, backed by the Mother Country's skilled mechanics and business men, may be relied upon, if properly encouraged by the public, to maintain for us the same place in the air that we have held on the seas for so many centuries. Let us see to it that the Government realises the vital necessity of the maintenance of civil and military flying. First to-day, we must remain first for all time."

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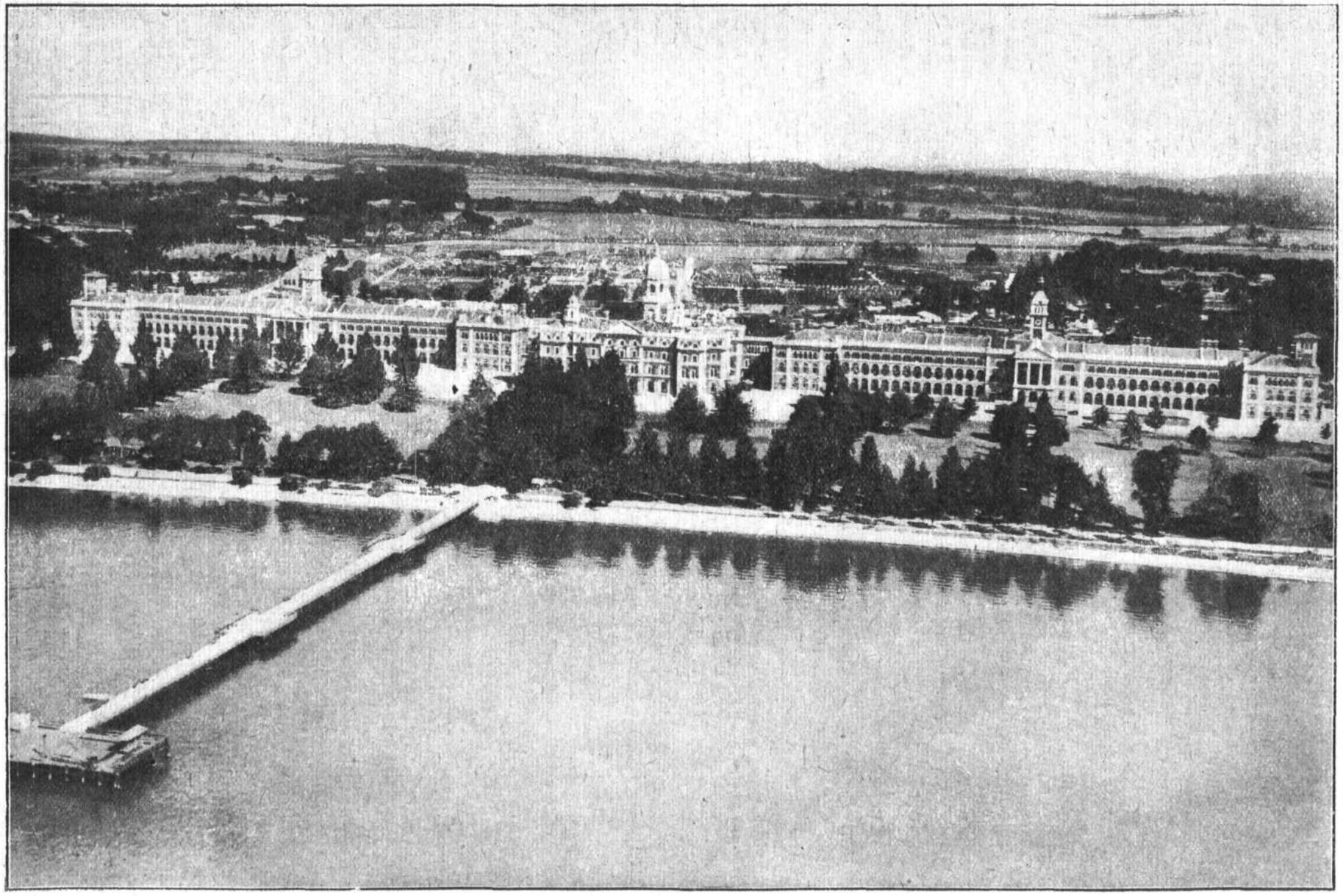
"For all Time" That is the essence of the whole question of the future of aviation—we must be first for all time. In the past, sea power has been the dominant factor in the peace of the world. Ever since the end of the Napoleonic wars, which were won by the might of Britain's sea power, the fleets of the British Empire have been a potent factor in keeping the peace and liberty of the world. Had it not been for those fleets the attempt of Germany to secure world-dominion must have been made at a much earlier period, and it might have been made more successfully. It was not until the aggressor in the late War had built up a fleet presumed to be strong enough to seriously challenge the sea power of Britain that she struck. In the meantime, however, her intentions had been made plain, and time had been given for those against whom her effort was to be directed to prepare for it.

We are of the school which believes that the keeping of the peace of the world lies in the possession of a non-aggressive nation of an overwhelming superiority of aerial force, and that the whole incidence of war has moved into the air. Fleets and armies will still be employed, but the decision will be made in the air. Nor are we alone in these opinions, for the same has been said many times by some of our most famous soldiers and sailors. Yet our purblind politicians, under the influence of the older schools of military and naval thought, still frame their policies as though they had learnt nothing from the War. Army and Navy Estimates are swollen to many times their pre-War proportions, while the Air Force is apparently regarded as a Cinderella of the Services and is being slowly strangled. Indeed, it would almost be correct to say that its life is very fast approaching extinction. When we regard the almost indecent haste with which the Air Force has been broken up since the Armistice, we begin to feel that the use of the word slowly is a misapplication of terms.

Lord Northcliffe is absolutely right when he says we must be "First for All Time." Whether he is equally right in saying that we are first today is not quite as certain. We are aware that a good deal of



Netley Hospital as seen from a Supermarine flying boat over Southampton Water

the activity in other countries, of which we hear a great deal, is simply paper work and represents more what those concerned would like to be doing than what has actually been accomplished. But after all is said and done, it is probably a fact that the Continental nations, with wider vision than ourselves, actually have a better appreciation of what air power means to the future existence of a great state than is possessed by our own politicians. At the risk of being accused of labouring an obvious point, we must once again insist that the only hope we have of arousing them to a sense of their duty towards aviation, both civil and military, is in the creation of the necessary volume of public opinion. No British Government ever does anything "off its own bat." All progress is made as a result of the pressure of public opinion, and until that pressure is used we fear nothing that matters will be done. Lord Northcliffe and Mr. Holt Thomas have done good service to the cause in "Aerial Transport," which should be read and pondered by all who have the slightest interest in the future of either side of the aviation movement.

Education and Research

Not long prior to the Armistice, Lord Weir appointed a Committee, under the chairmanship of Sir Richard Glazebrook, to consider what steps should be taken to organise education and research in aeronautics after the War. Later, the Government arrived at certain conclusions as to the provision to be made in this direction, and in November last the Committee was asked to consider these decisions and to submit recommendations for giving them practical effect. A Report has now been rendered to the Air Minister and issued as a White Paper. The full text of the Report was printed in the last issue of FLIGHT. It will be seen that the Committee lays stress on the necessity for research, and emphasises that something more than the Government proposals is necessary. It points out that: "At the present moment the industry is passing through a crisis; Government support is necessary if it is to emerge satisfactorily. The time is critical and the development of civil aviation is beset by numerous difficulties and calls for the fullest consideration. It is urgently necessary that the policy adopted should command the support of all who desire to maintain the superiority in the air gained during the past eventful years, and that ample funds should be provided for carrying it into effect."

The Committee then goes on to point out that a research organisation may elucidate problems, provide information and specific facts, but before these can bear fruit of industrial value they must be interpreted and applied by a suitable technical staff, closely associated with a works' organisation. At the end of the War most of the works had collected a team of technical experts of marked ability. Many of these teams have been disbanded and the process of disintegration is still in progress. The Committee "sees no possibility of achieving the desired result except by such Government action as will secure the retention of adequate technical staffs." Precisely what we and many others have been trying to impress upon the Government for months past. We trust most sincerely that the words of the Committee will fall upon ears less deaf than the protests of those outside the charmed circle of officialdom.

In so far as concerns the subjects of the enquiry, the Committee has come to two main conclusions. In the matter of education the recommendation is that post-graduate courses of advanced study should be established at the Imperial College, where there is already established the Zaharoff professorship, which supplies the nucleus of the organisation necessary for higher training. It is also proposed that there should be an Aeronautical Research Committee for the purpose of providing facilities for the advancement of the practical and experimental side of the science. It should be left to the governing body of the Imperial College and the Aeronautical Research Committee to determine a method of co-operation. Finally, it is estimated that the cost of the proposed department would be approximately £10,000 a year. Other expenditure involved in the Committee's proposals is already provided for in the votes of the Air Ministry and the Department of Scientific and Industrial Research.

The sum involved, viz., £10,000 a year, does not seem to err on the side of extravagance, but the Committee had all the facts and data before it, and doubtless its members are perfectly satisfied that the work can be done for that sum. It may be pointed out, however, that unless what we regard as the most important view of the Committee—that relating to assistance for the industry and for civil aviation—is taken to heart by the Government, an expenditure of £10,000 per annum will be wasted, for the very sufficient reason that there will not be the necessary "suitable technical staffs, closely associated with a works organisation," to interpret the facts elucidated by the Research Department.

The Gordon-Bennett Challenges

THREE American aeroplanes have been entered by the Aero Club of America for the contest for the Gordon-Bennett Aviation Cup, which is to be held in the Beauce Province in France in the autumn. Belgium also has made an entry.

Speed Records in France

AT Villacoublay on February 28, Casale on his 300 h.p. Spad-Herbemont beat Sadi-Lecointe's speed record of 275·862 kiloms. per hour. Casale's average speed was 283·464 kiloms. per hour, but in one of his trials he covered two kiloms. in 25 secs., a speed of 288 kiloms. per hour.

A Dirigible Over Paris

SOME excitement was caused in Paris a few days ago by the appearance of a large dirigible which some thought must be a Zeppelin surrendered by the Germans. As a matter of fact, it was the A.T. 18, a new French naval dirigible, making its first five hours' flight. With 22 passengers on board it cruised above the Marne, Rheims, Chateau-Thierry, and landed at St. Cyr at 3 p.m.

The Timbuctoo Flight

A MESSAGE received at the French Ministry of the Colonies on February 25 from Maj. Vuillemin reported that on the evening of the day (February 18) he left Tamahrasset, he landed at Menaka, about 400 kiloms. (250 miles) west of Timbuctoo, whither he was continuing his flight. No word had been heard of the second aeroplane, which is making the same flight, piloted by Lieut. Bernard, with Gen. Lapperine on board.

Fast Flying in Italy

LIEUT BRACK-PAPA is credited with having flown recently at Mirafiori, with four passengers, at a speed of 260·830 kiloms an hour (161½ m.p.h.). The flight which was made on February 26, was controlled by the Aero Club of Italy. An A.R.F. biplane, fitted with a Fiat 12-cylindered 750 h.p. engine, was used, and it is claimed that it has already covered 166 miles an hour with the pilot only on board.

The Rome-Tokyo Flight

THE two S.V.A. aeroplanes which left Rome for Tokyo on February 16 have now become separated. The one piloted by Lieut. Ferrarin reached Baghdad on February 22 and left on the following day for Bunder Abbas and Karachi, while the other, with Lieut. Masiero in charge, only completed the stage from Aleppo to Baghdad on February 25.

FLIGHT

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

ANNUAL GENERAL MEETING

THE Annual General Meeting of the Members of the Royal Aero Club of the United Kingdom will be held on Tuesday, March 30, 1920, at 3, Clifford Street, New Bond Street, London, W. 1, at 6 p.m.

Notices of Motion for the Annual General Meeting must be received by the Secretary not less than 21 days before the Meeting, and must be signed by at least five Members. The last day for the receipt of Notices of Motion is Tuesday, March 9, 1920.

Committee

In accordance with the Rules, the Committee shall consist of eighteen Members. Members are elected to serve for two years, half of the Committee retiring annually. Retiring Members are eligible for re-election.

The retiring Members of the Committee are :—

Brig.-Gen. The Duke of Atholl, K.T., M.V.O., D.S.O.
Maj.-Gen. Sir Sefton Brancker, K.C.B.
Mr. Ernest C. Bucknall.
Mr. G. B. Cockburn.
Col. F. Lindsay Lloyd, C.M.G.
Lieut.-Col. J. T. C. Moore-Brabazon, M.C., M.P.
Lieut.-Col. M. O'Gorman, C.B.
Group-Capt. C. R. Samson, C.M.G., D.S.O., R.A.F.
Mr. A. Mortimer Singer.

Any two Members of the Club can nominate a Member to serve on the Committee, provided the consent of the Member has been previously obtained. The name of the Member thus nominated, with the name of his proposer and seconder, must be sent in writing to the Secretary not less than 14 days before the Annual General Meeting. The last day for the receipt of nominations is Tuesday, March 16, 1920.

SPECIAL COMMITTEE MEETING

A Special Meeting of the Committee was held on Wednesday, February 25, 1920, when there were present :—Brig.-Gen. Sir Capel Holden, K.C.B., F.R.S., in the Chair, Maj.-Gen. Sir Sefton Brancker, K.C.B., Mr. Ernest C. Bucknall, Mr. G. B. Cockburn, Lieut.-Col. Spenser D. A. Grey, D.S.O., Lieut. Col. F. K. McClean, Air-Commodore E. M. Maitland, C.M.G., D.S.O., R.A.F., Lieut.-Col. Alec Ogilvie, Group-Capt. C. R. Samson, C.M.G., D.S.O., R.A.F., and the Secretary.

Election of Members.—The following New Members were elected :—

Edward Hale Tindal Atkinson.
Henry Leitner.
Major Geoffrey Harold Brinkman McCall (late R.A.F.).
Sir Napier Shaw, F.R.S.

Flying Services Fund.—The report of the Meeting of the Flying Services Fund Committee held on February 20, 1920, was received and adopted.

Committees of the Federation Aeronautique Internationale.—The following Members were appointed to represent the Club on the Committees of the Federation Aeronautique Internationale :—

Touring	..	Lieut.-Col. Spenser D. A. Grey, D.S.O.
Medical ..	..	Wing-Commander Hardy Vesey Wells, C.B.E., R.A.F.
Cartographic	..	Lieut.-Col. Spenser D. A. Grey, D.S.O.
Engines ..	..	Eng.-Com. Wilfrid Briggs, R.N.
Law ..	..	Mr. E. H. Tindal Atkinson.
Meteorological	..	Sir Napier Shaw, F.R.S.

Aero Clubs of Poland and Czecho-Slovia.—Letter was read from the Federation Aeronautique Internationale, dated February 20, 1920, asking whether the Club would agree to the temporary affiliation to the Federation Aeronautique Internationale of the Aero Clubs of Poland and Czecho-Slovia, pending the next Conference of the Federation Aeronautique Internationale.

It was decided to agree to these Clubs being temporarily affiliated to the Federation Aeronautique Internationale.

Proposed Alcock Memorial at Rouen.—Letter was read from the Aero Club of Rouen, dated February 17, 1920, asking the Club to give its support to the erection of a memorial to the late Sir John Alcock where his fatal accident occurred.

It was decided to subscribe to the Memorial, but, before settling the amount, the Secretary was instructed to ascertain what the cost would be.

Racing Committee.—Group-Capt. C. R. Samson, C.M.G., D.S.O., R.A.F., submitted report of the Racing Committee, which was unanimously adopted.

It was decided to set apart a sum of £2,000 to form a Racing Fund to be administered by the Racing Committee.

Certificates.—The following Certificates were granted :—

Aviators' Certificates Nos. 7,805-7,856.
Aeronauts' Certificates Nos. 272-273.
Airship Pilot's Certificate No. 65.

THE FLYING SERVICES FUND

(*Registered under the War Charities Act*, 1916)

Administered by the Royal Aero Club

For the benefit of *Officers, Non-Commissioned Officers and Men* of the ROYAL AIR FORCE who are incapacitated while on duty, and for the widows and dependants of those who are killed or die from injuries or illness contracted while on duty.

Honorary Treasurer :
The Right Hon. LORD KINNAIRD.

Committee :
H.R.H. PRINCE ALBERT, K.G. (*Chairman*).
Lieut.-Col. A. DORE, D.S.O.
Mr. CHESTER FOX.
Squad. Leader T. O'B. HUBBARD, M.C., R.A.F.
Squad. Leader C. E. MAUDE, R.A.F.
Group Capt. C. R. SAMSON, C.M.G., D.S.O., R.A.F.

Secretary :
H. E. PERRIN.

Bankers :
Messrs. BARCLAYS BANK, LTD., 4, Pall Mall East, London, S.W. 1

Subscriptions :

	£	s.	d.
Total subscriptions received to Feb. 14, 1920	16,988	17	7
Mrs. A. FitzGerald	10	0	0
Total, February 28, 1920	16,998	17	7

Offices: THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W. 1.
H. E. PERRIN, Secretary.

Sirdar's Aerial Inspection

SIR LEE STACK, the Sirdar, has made his first aerial inspection by the aid of a Vimy bomber. His trip, which took in Dueim, Sennar, Makwar, and Jebelein, normally would occupy at least three days, but on this occasion it was completed in 7 hours 20 mins.

Suspension of Indian Air Mail

IT is officially announced that the air mail service recently established between Bombay and Karachi will be discontinued after the arrival of the mail which left London on the 19th inst. No further packets should be posted for transmission by this service. The special fee of 1*s.* per oz. prepaid on packets posted since the 19th inst., will be refunded to the senders on application to the Secretary, General Post Office, London, E.C. 1.

An N.Z. Air Mail Service

AN experimental seaplane mail service is to be started between Auckland and provincial seaports, reports *The Times* correspondent at Wellington. If the service is successful it will be extended to remote districts.

A NEW AVRO TRIPLANE

SPECIAL interest attaches to the latest production of the Avro Co., which has just successfully gone through its trials at Hamble, inasmuch as it revivifies the early activities of this pioneer firm, when Mr. A. V. Roe produced—if not originated—the tractor triplane type of machine. As Mr. A. V. Roe has always been a great believer in the triplane, it is but natural that his firm should have further developed the type.

This new Avro, known as type 547, is seen in the accompanying photograph and scale drawings. It is a purely commercial machine, and is intended for passenger, cargo, or mail work. Accommodation for four passengers, in addition to the pilot, can be arranged for, whilst for cargo or mail work removal of the seats gives a space of 113 cubic feet. In general appearance the machine follows familiar Avro lines, which may, perhaps, be accounted for by the fact that it is built largely from parts of the standard type 504K Avro biplane. Incidentally, this is quite an important feature, not only making for cheap production, but greatly facilitating the maintenance of the machine, as there should be no difficulty in obtaining spares almost anywhere.

The *fuselage* is on more or less conventional lines, and is extra deep to allow for the provision of a cabin for the passengers. This is located immediately aft of the rear main plane spars, and is fitted up somewhat on the lines of a railway carriage, the seats being arranged for two passengers facing forwards and two rearwards. Access to this cabin is by means of a door in the side of the *fuselage*, whilst large Triplex windows on either side provide an excellent view for the passengers.

The pilot is located well back along the *fuselage*, at the rear of the cabin, with his head projecting above the top of the *fuselage*. From here he has an excellent view in all directions, which, it is claimed, is aided considerably by the triplane arrangement.

A 160 h.p. Beardmore six-cylinder vertical water-cooled engine is installed in the nose of the *fuselage*, where it drives a tractor screw. A comparatively low petrol consumption is obtained with this engine—in this particular case 9 miles to the gallon with five up and cruising at 80 m.p.h.

All three main planes are of equal span, 37 ft. 3 ins., and chord, 4 ft. 9¾ ins. They are set at a dihedral angle of 2½°, but have no sweep back or stagger. *Ailerons* are fitted to all three planes, those on the middle ones being balanced by means of a small surface mounted forward of and above the leading edge of the *aileron*—a practice employed by the Germans during the War on large multi-engined bombers.

The landing chassis is of the standard Avro type, whilst the rest of the machine appears to be on more or less standard lines, and does not, therefore, call for special comment.

Side view of the Avro Type 547 Triplane, 160 h.p. Beardmore

The principal characteristics of the Avro 547 Triplane are as follows :—

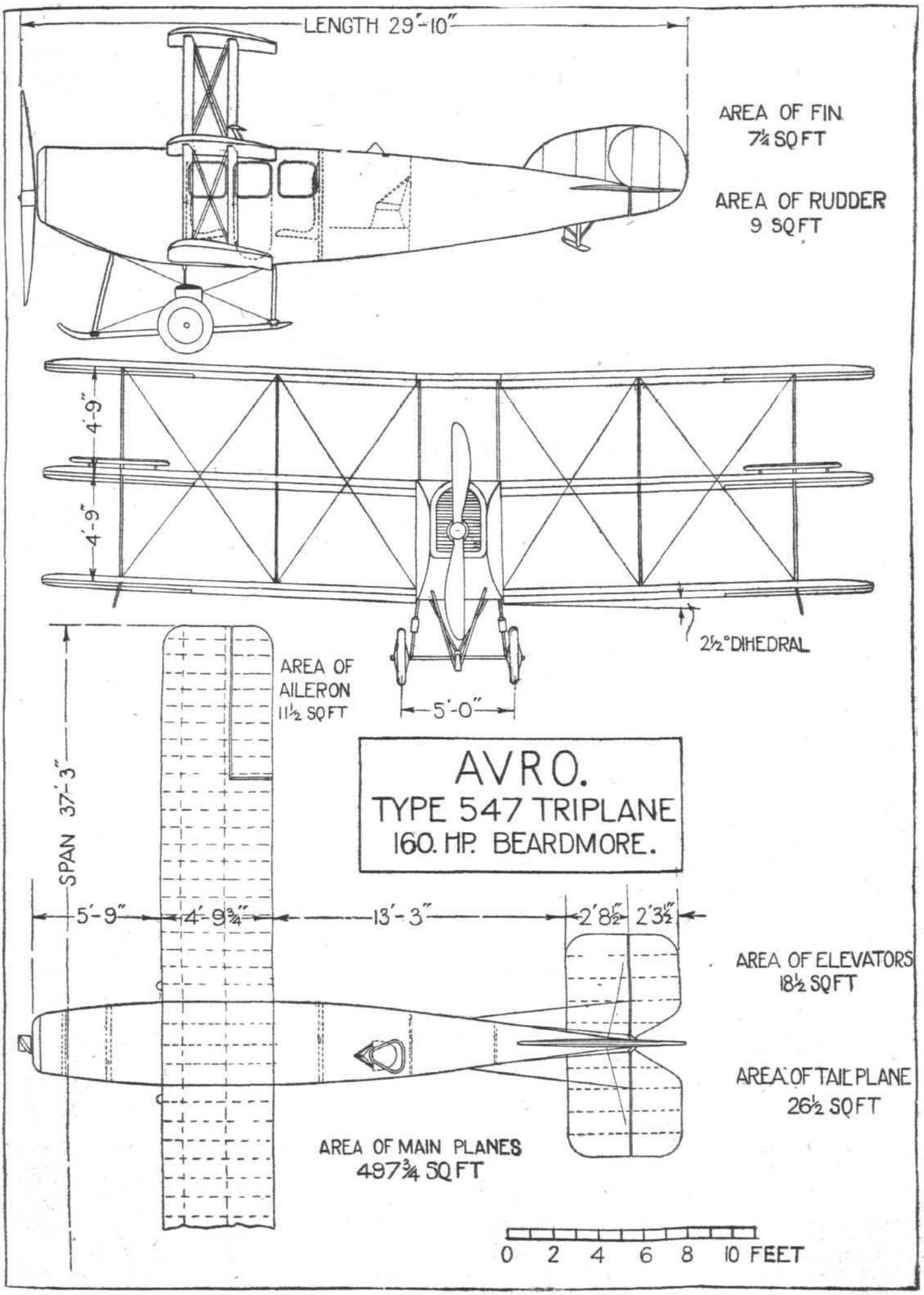
Span (all planes)	37 ft. 3 ins.
Chord ,, ...	4 ft. 9¾ ins.
Gap ,, ...	4 ft. 9 ins.
Dihedral angle	2½°.
Overall length	29 ft. 10 ins.
Overall height	14 ft. 5 ins.
Area of main planes (including *ailerons*	497¾ sq. ft.
,, *ailerons* (six)	69 sq. ft.
,, tail plane	26·5 sq. ft.
,, elevators	18·5 sq. ft.
,, fin	7·25 sq. ft.
,, rudder	9 sq. ft.
Weight fully loaded	3,000 lbs.
Loading per sq. ft.	6 lbs.
,, h.p.	18·8 lbs.
Speed range	45-94 m.p.h.
Cruising speed	80 m.p.h.
Fuel consumption at cruising speed	9 galls./hr.
Climb to 5,000 ft., 15 mins. ; 1,000 ft., 38 mins.	

The French Railway Strike

THE railway strike in France last week provided another opportunity of demonstrating the possibility of aerial transport, and both the *Daily Mail* and *The Times* rose to the occasion. The whole of the Continental supplies of *The Times* on Saturday was dispatched by aeroplane, the consignment, which weighed over a ton, being received in Paris about 6 p.m. The Continental *Daily Mail* also arranged for supplies of the paper to be sent by aeroplane from Paris to Lyons and the Riviera. The consignment was taken on a De H. 4, belonging to Messrs. S. Instone and Co., and piloted by Mr. F.L. Barnard and Mr. H. W. Chettaway.

There was naturally an increased demand for seats on the "air expresses," and five Airco machines were flown on the London-Paris service on Saturday.

Arrangements were made by the French Government for aeroplane services to Marseilles, Lille, Brussels and London to commence on March 1.



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THE AVRO TYPE 547 TRIPLANE: Plan, side and front elevations to scale

LOAD FACTORS FOR HEAVIER-THAN-AIR CRAFT

THE following Technical Memo. No. 12 of the Advisory Committee for Aeronautics, dated January 6, 1920, has been issued by the Air Ministry :—

Introduction

When the employment of aircraft for civil purposes became practicable, owing to the termination of hostilities, representatives of the aircraft industry pointed out the necessity for arriving at an agreement as to the load factors to be worked to in designing commercial aircraft. Although knowledge on this subject had increased very largely during the War the bases and methods upon which designers worked varied considerably, and it was obvious that the matter was one requiring careful technical investigation.

The Air Council therefore requested the Advisory Committee for Aeronautics to appoint a Sub-Committee—upon which the various interested bodies should be represented—to consider and report as to the definite rules which should be adopted to govern the load factors required for all classes of civil aircraft, and upon which Certificates of Airworthiness may be based. Accordingly the Sub-Committee was constituted as follows :—

The Chairman of the Advisory Committee for Aeronautics (*ex officio*).

Air Council : Lieut.-Col. W. D. Beatty, R.A.F., Sqdn. Leader F. H. Bramwell, R.A.F.

Royal Aeronautical Society : Lieut.-Col. O'Gorman, C.B., Mr. L. Bairstow, C.B.E., F.R.S.

Society of British Aircraft Constructors : Mr. F. Handley Page, Capt. F. S. Barnwell, Mr. H. Smith, Mr. H. O. Short.

Advisory Committee for Aeronautics : Prof. J. E. Petavel, F.R.S., Mr. F. W. Lanchester, M.Inst.C.E., Mr. R. V. Southwell, M.A., Dr. T. E. Stanton, F.R.S.

Sir Richard Glazebrook was appointed by the Sub-Committee as its chairman. Mr. F. Handley Page was represented on certain occasions by Mr. H. O. Boswell or Lieut.-Col. E. T. Stedman. Mr. H. O. Short was represented by Maj. Gnosspelius. At one meeting Mr. A. J. Sutton Pippard attended as a representative of the Royal Aeronautical Society in place of Lieut.-Col. O'Gorman, and Mr. Douglas, of the Royal Aircraft Establishment, also attended one meeting by invitation.

The unanimous report of this Sub-Committee, which has now been approved, is given below. Its provisions will be made applicable to designs submitted to the Director of Research after March 15, 1920. This memorandum will appear in due course as Report No. T.1425 of the Advisory Committee for Aeronautics.

Schedule of Load Factors for Heavier-than-Air Craft

Heavier-than-air craft are now used for a variety of purposes, including on the one hand purely commercial work, and on the other stunt flying. The strength necessary for safety is different in the two classes : for the former class the specification need not be so exacting as for the latter in order to ensure adequate safety ; further, a lower factor is commercially desirable since an increase of load factor involves a decrease in the range and load-carrying capacity. Heavier-than-air craft have, therefore, been divided into two classes having regard to the different qualities of airworthiness required. This separation will necessitate the granting of two distinct types of certificates : it has been suggested that these should be readily distinguishable by the use of different colours or other means. The aircraft in the "General" Class, including all those not in the "Commercial" Class, should be sufficiently strong to allow of stunt flying of all descriptions. The other class, "Commercial," will include craft used for strictly commercial work involving only straight flying ; stunting of any kind will be prohibited. The schedule below is given in tabular form under these two heads.

In preparing this schedule the Load Factor Sub-Committee of the Advisory Committee for Aeronautics considered only future designs ; it is not intended that the schedule should be made applicable to machines already approved or designs submitted prior to some future date to be fixed by the Air Ministry. Further revision of the present schedule from time to time will doubtless be necessary in order that it may remain in accordance with the demands arising from improvements in the constructional methods and design.

Method of Specifying Strength.—The first specification (*a*) determines the load factor when the centre of pressure is in its most forward position : this gives in each case a definite load for every part of the machine, including the tail plane and the *fuselage*.

The second specification (*b*) gives the load factor when the centre of pressure is in the position corresponding to maximum horizontal speed at ground level. This also gives a definite loading.

The next specification (*c*) gives the factor of safety in a terminal nose dive, a condition which is again quite definite for each aircraft, the air screws being assumed to be removed.

The above are considered sufficient to determine the strength of the wings and of the tail plane ; also for certain loadings of the *fuselage* when in flight.

For the strength of the fin and rudder, specification (*d*) gives the value of an assumed lift coefficient, which, when the maximum speed of the craft is known, determines uniquely the strength required in these parts, and also in so far as the lateral loadings are concerned in the *fuselage* ; the values assumed for the lift coefficient are considered sufficient to cover adequately the maximum forces which can be imposed on the rudder and fin by the pilot when exerting his full force so as to obtain as rapid a turn as possible.

Strength of undercarriages, specification (*e*), is dealt with under the conditions of both static and dynamic loads, neither case being considered sufficient by itself to meet all requirements.

For the use of the tables it should be noted that the two terms, factor of safety and load factor, are defined in the accepted engineering sense, *i.e.*,

$$\text{Factor of safety} = \frac{\text{Failing strength of a member of the structure.}}{\text{Worst possible load occurring under any condition of flight.}}$$

$$\text{Load factor} = \frac{\text{Failing strength of a member of the structure.}}{\text{Load in member under horizontal steady flight conditions.}}$$

In addition to the figures given in the tables, on this and the following page, it is essential (*f*) that, in the case of any one flying wire, or duplicate pair of wires, being removed from the aircraft, the strength of the remaining portion should be such that at least one-half of the scheduled load factors and factors of safety shall be obtained under each of the foregoing conditions. For this particular case incidence or other normally redundant bracing is naturally assumed operative where necessary.

COMMERCIAL CLASS.

	Total weight of aircraft.			
	Up to 5,000 lbs.	5,000 to 10,000 lbs.	10,000 to 30,000 lbs.	Above 30,000 lbs.
(*a*) Load factor with C.P. in its most forward position ..	6†	6† − 5*†	5† − 4*	4
(*b*) Load factor with C.P. in the position corresponding to maximum horizontal speed at ground level ..	4·5†	4·5†−3·75*†	3·75† − 3*	3
(*c*) Factor of safety in terminal nose dive ..	1·75†	1·75†	1·75*	1·75†
(*d*) Specified lift coefficient for fins and rudders. (Under this loading the factor of safety of the *fuselage* should be unity) ..	0·5	0·5	0·5	0·5
(*e*1) Static load factor on undercarriages ..	6	6 − 5*	− 4*	4
(*e*2) Specified vertical velocity (ft./sec.) for determining travel of undercarriages	10	10	10	10

* The decrease in load factor from the larger value is directly proportiona to the increase in the weight of the craft.

† In the case of aircraft which are longitudinally stable over the whole flying range, these figures may be reduced by 0·5.

SCHEDULE OF LOAD FACTORS AND FACTORS OF SAFETY. GENERAL CLASS.

	Total weight of aircraft.		
	Up to 3,000 lbs.	3,000 to 10,000 lbs.	Above 10,000 lbs.
(*a*) Load factor with C.P. in most forward position	8	8 — 6*	6
(*b*) Load factor with C.P. in the position corresponding to maximum horizontal speed at ground level	6	6 — 4·5*	4·5
(*c*) Factor of safety in a terminal nose dive	1·75	1·75	1·75
(*d*) Specified lift coefficient for fins and rudders. (Under this loading the factor of safety of the *fuselage* should be unity)	0·6	0·6	0·6
(*e*1) Static load factor on undercarriages	8	8 — 6*	6
(*e*2) Specified vertical velocity (ft./sec.) for determining travel of undercarriages	10	10	10

* The decrease in load from the larger value is directly proportional to the increase in the weight of the craft.

Methods of Calculation.—In using the above schedules the calculations of strength will be checked by the methods of the Handbook of Strength Calculations (H.B. 806, second edition), published by the Technical Department, Air Ministry. In all calculations and in specifications of load factors and factors of safety, design figures should be employed and not those obtained from breaking tests. Further, when dealing with steel tubes, the specifications of the Engineering Standards Committee, based on the figures for yield points, are approved for stress calculation purposes; for stream line wires the breaking load should be taken in preference to the yield point which is, in these cases, ill-defined. Redundant wires, except as mentioned in (*f*), are to be considered as neglected.

With a view to facilitating the use of the schedule, the following additional matter should be noted.

(1) That for (*a*) and (*b*) the positions of the centre of pressure should preferably be determined by a test on a model with a 6-in. chord at 60 ft./sec., but that the Air Ministry might agree to issue a certificate based on results for a monoplane model of 3-in. chord tested at 40 ft./sec. For biplanes, a biplane test is preferred; similarly for triplanes.

For case (*b*) the maximum horizontal speed at ground level should be obtained from the formulæ given in (2) below. From this speed the value of the lift coefficient is obtained and the position of the centre of pressure determined from model tests as defined above.

(2) That for (*b*) and (*d*) the maximum speed at ground level should be defined by the following formulæ giving the maximum speed for given loadings and weight of aircraft. Should the manufacturer desire to specify the maximum speed in any other manner he is at liberty to make a special application.

For single engine aircraft—

$$\left(V\sqrt{\frac{\rho}{\omega}}-1\cdot79\right)^2=3\cdot16\left(N\sqrt{\frac{\rho}{\omega}}-0\cdot316\right)$$

Where N, V, ω and ρ are the power per unit weight, the speed, the loading and the density in any system of consistent units; *e.g.*, N in ft. lbs. per sec. per lb.

For multi engine aircraft—

$$\left(V\sqrt{\frac{\rho}{\omega}}-1\cdot64\right)^2=2\cdot99\left(N\sqrt{\frac{\rho}{\omega}}-0\cdot310\right)$$

V in ft./sec. ω in lbs./sq. ft. and ρ in slugs/cub. ft. (a ground level).

For boat seaplanes—

$$\left(V\sqrt{\frac{\rho}{\omega}}-1\cdot425\right)^2=2\cdot74\left(N\sqrt{\frac{\rho}{\omega}}-0\cdot304\right)$$

The above formulæ may also be expressed in the form :—

For single engine aircraft.

$$\left(\frac{V}{\sqrt{\omega}}-25\right)^2=16\cdot6\left(\frac{N}{\sqrt{\omega}}-11\cdot8\right)$$

For multi engine aircraft.

$$\left(\frac{V}{\sqrt{\omega}}-23\right)^2=15\cdot7\left(\frac{N}{\sqrt{\omega}}-11\cdot6\right)$$

For boat seaplanes.

$$\left(\frac{V}{\sqrt{\omega}}-20\right)^2=14\cdot4\left(\frac{N}{\sqrt{\omega}}-11\cdot35\right)$$

Where N is horse-power per 1,000 lbs. *i.e.* $\frac{1{,}000 \text{ h.p.}}{W}$

W being the weight of H.P. the horse-power of the aircraft in question.

V is in miles per hour at ground level; and ω is wing loading in lbs. per sq. ft.

(3) That for (*c*), the case of the limiting nose dive calculations submitted by the manufacturers would be considered by the Air Ministry; otherwise, the following table with the necessary extensions for other wing sections would be employed.

Table of tail plane loads in limiting nose dive.

Type of Aircraft	Wing Section Employed	
	R.A.F. 15	R.A.F. 60
Single engine	$0\cdot6\ \frac{Wc}{l}$	$0\cdot9\ \frac{Wc}{l}$
Multi-engine	$0\cdot55\ \frac{Wc}{l}$	$0\cdot7\ \frac{Wc}{l}$
Boat seaplane	$0\cdot5\ \frac{Wc}{l}$	$0\cdot5\ \frac{Wc}{l}$

Where W is the weight of the aircraft.

c is the chord of the main planes,

and *l* is the distance from the centre of gravity of the aircraft to the centre of pressure of the tail plane.

(4) That in the case of (*d*) the static strength of the undercarriage should be checked for the four following cases :—

(i) When the aircraft lands on an even keel and with the chord of the main planes horizontal.

(ii) When the aircraft lands on an even keel and so that the tail skid and undercarriage touch the ground simultaneously.

(iii) When the aircraft lands so that one wing tip touches the ground at the same time as the main undercarriage and with the chord of the main planes horizontal.

(iv) When the aircraft lands so that one wing tip touches the ground at the same time as the main undercarriage and so that the tail skid and undercarriage touch the ground simultaneously.

In (i) and (ii) the load factor should be that specified, and in (iii) and (iv) the load factor should be at least half that specified.

As regards length of travel of the undercarriage, its amount should be such that the total work of compression is equal to the value of $\frac{1}{2}(wv^2)/g$ where w is the weight of the machine and v is the specified vertical velocity; also, the maximum load should not exceed the specified static load on the undercarriage.

Smaller and Cheaper Aeroplanes

LECTURING at King's College to L.C.C. school-teachers on "Aviation and the Possibilities that await the Development of the Aeroplane," Mr. F. Handley Page pointed out that during the War economy in the cost of running played no part in the design. Their experiments had been directed to finding out whether it would not be possible to fly with smaller planes, and one of their interesting discoveries indicated that we should be able to use planes of at least half the size of the present area. Experiments showed that they would be able to land slower with these smaller machines and that with 25 h.p. instead of 100 h.p. they would be able to fly with pilot and passenger, and with enough petrol and oil for five hours at a speed of 100 to 110 miles an hour. Such a machine would cost from £150 to £200.

"Which means," said Mr. Page, "that we shall be able to get a small machine that you can put perhaps in the coal-shed, and drag it out on a fine Saturday afternoon for a trip to any destination within a range of 500 miles at a cost no greater than that of running a small motor car."

The price of flying from London to Paris will be comparable in the future, said the lecturer, with travelling by omnibus from the Bank to Charing Cross, though it will be a long time ahead yet, as at present we have only the old type of machines. Development, however, would be along the cheaper lines he had indicated.

"With the enormous production of motor-cars here and in America and other places, the day is not far distant when it will be impossible to move along the roads; and there will be only one thing left to do if you want to go anywhere, and that is to travel by air."

H.P. Paris and Brussels Air Service

ON the Handley Page Continental Air Services, between September 2, 1919, and February 26, 1920, 976 passengers and 46,383 lbs. of freight have been carried over a distance of 71,369 miles.

20th Squadron R.A.F.

IT is proposed to hold a reunion dinner in London. All past members are requested to communicate with J. A. HONE, 23, Palmerstone House, Old Broad Street, London, E.C., who will inform them when definite arrangements have been made.

REPORT ON THE JUNKER ARMOURED TWO-SEATER BIPLANE, TYPE J.1

(*Continued from page* 233.)

Struts

THE arrangement of struts is one of the most interesting features of the Junker biplane. Examination of the photographs will reveal the fact that there are three groups of struts.

1. Struts connecting upper plane to lower plane (marked A and B in photograph Fig. 10).

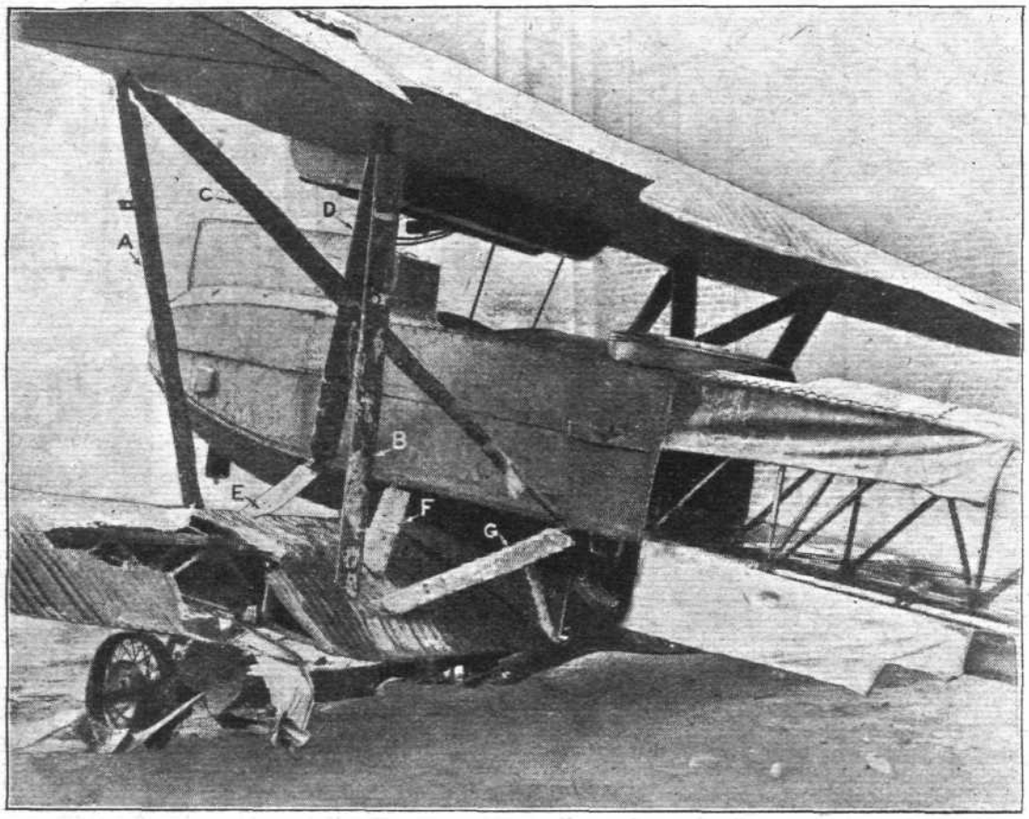


Fig. 10

There are two pairs of these: one pair on each side of the body.

2. Struts connecting the upper extremities of A and B to the lower edge of the *fuselage* side (marked C and D in photograph). It will be noticed that these struts cross from front to rear, and that interference between the two is prevented by arranging that their upper extremities fall on different chords (*see* front view, general arrangement drawings).

3. Struts connecting the lower edge of the *fuselage* side to those points in the lower plane to which the undercarriage struts are fixed (marked E, F, G in photograph).

All these struts are of steel tube covered with aluminium fairing. Steel formers are welded to the tube at intervals, and to these the fairing is riveted. The two edges of the fairing are turned in and joined together, at the narrow rear edge, by means of split pins. The longer tubes at least, and probably all, are of 4 cm. diameter and 15 gauge. They are joined to the spars by means of riveted steel collars carrying welded-on lugs.

At the *fuselage*, the struts finish in fork-ends, and are bolted to lugs welded to small steel plates riveted to the armour-plate. These lugs are shown in Fig. 14.

Fuselage

The body of the Junker is constructed in two distinct parts—a front armoured portion, and a rear portion built up of duralumin tubes.

The armoured part, the dimensions of which may be read from the drawing of the *fuselage* on page 263, is built of 5 mm. steel plate. The Junker is not an ordinary two-seater machine to which armour has been subsequently added, but the armour plate comprises the *fuselage*, as would be expected. The various photographs show clearly the shape of the body, also the number and size of the plates which

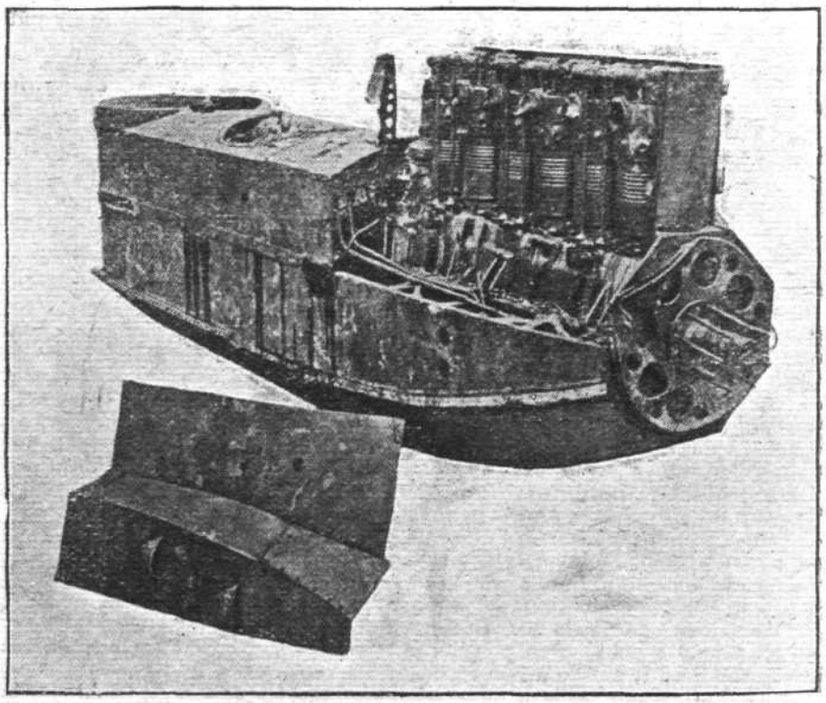
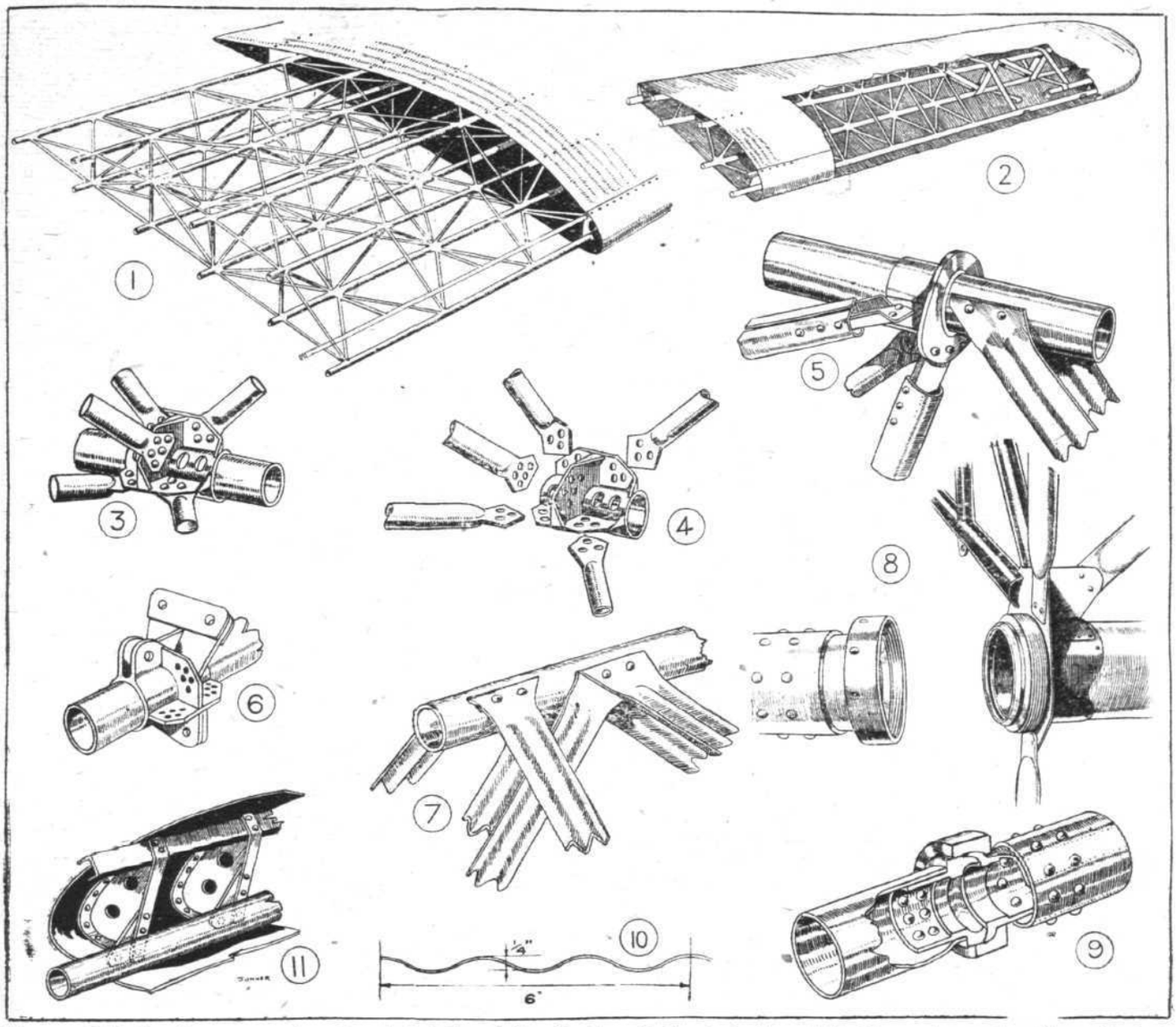
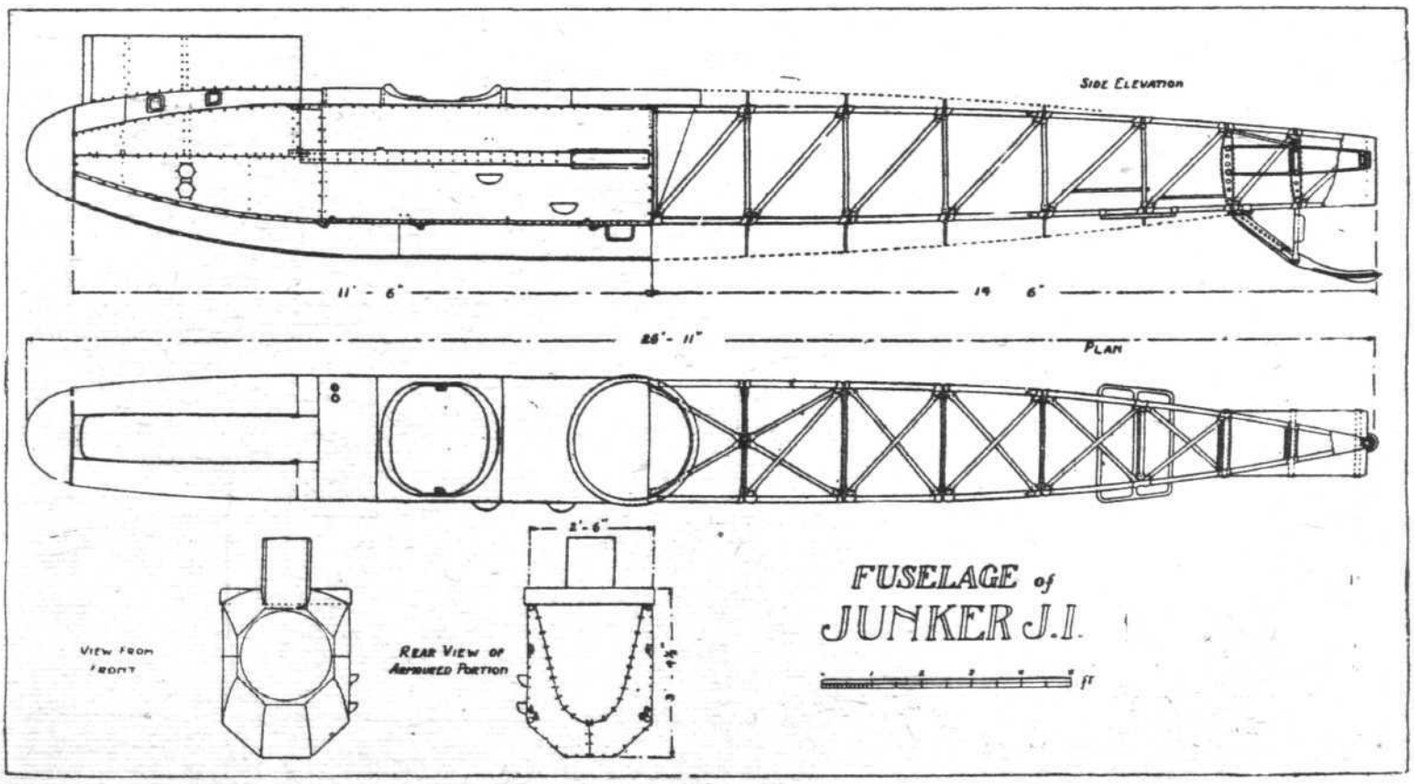


Fig. 11



Above: Fig. 8.—Some constructional details of the Junker J. 1 wing: 1 and 2. General construction of wing. 3 to 7. Details of wing braces. 8 and 9. Details of wing attachment. 10. Details of corrugated sheet covering. 11. Detail of leading edge. Below: Fig. 9.—Scale drawings of the fuselage



are riveted together. A section of the *fuselage* is shown in Fig. 13; the bracing strips are made of duralumin.

The armoured unit houses the engine, pilot, and gunner, and the petrol tank. The vertical cowl surrounding the

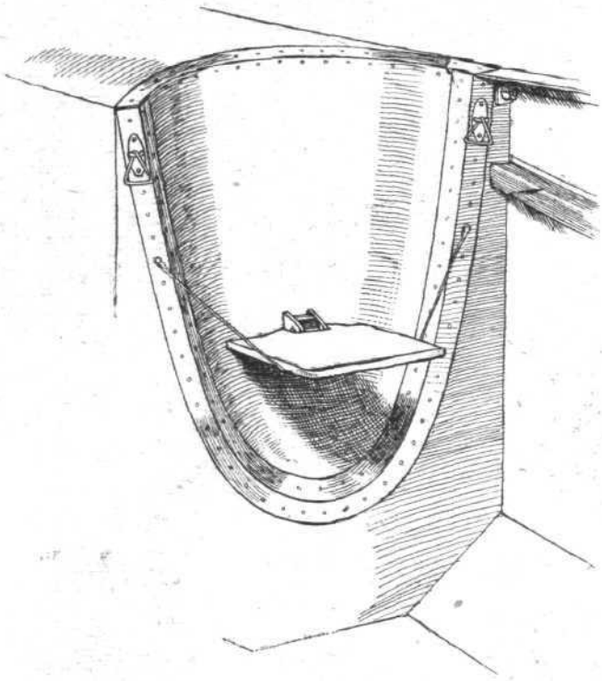


Fig. 12

engine cylinders is of armour plate, and is not a mere fairing. The spinner which covers the propeller boss is made of aluminium. The armouring is very thorough, so that the chances of a bullet finding a vulnerable spot are small.

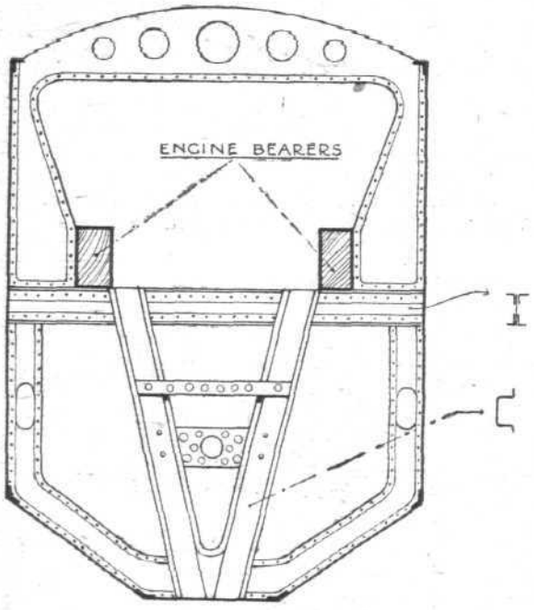


Fig. 13

Fig. 12 shows the rear of the armoured portion, together with the observer's seat.

The rear portion of the body is built of duralumin tube throughout, and is covered with laced-on fabric. There are four *longerons*, so arranged that the *fuselage* ends in a vertical knife-edge about 16 ins. long. Cross tubes are arranged horizontally and vertically at intervals. The diagonal bracing is not of wire, as is the case in the D 7 Fokker and the A.E.G. (which, it will be remembered, also have *fuselages* of metallic tubes). Diagonal tubes perform this function in the Junker. The arrangement of bracing tubes may be gathered from Fig. 18, and is worthy of careful attention.

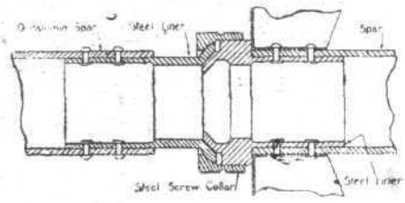


Fig. 16

The junction of the duralumin tubes is effected by means of steel sleeves which embrace the *longerons* tightly and are pinned to them. The exact shape of one of these clips is shown in Fig. 17. It will be noticed that the cross and diagonal tubes are flattened at their extremities, and riveted to approximate shelves welded on to the clip. Three-ply formers are fixed to the upper and lower cross tubes, and (in the case of the deeper lower formers, at any rate) are joined

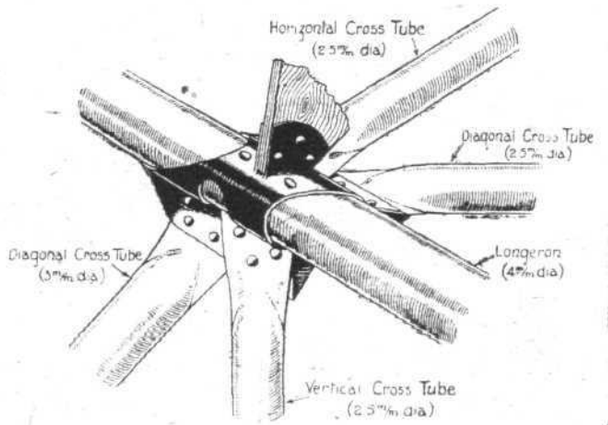


Fig. 17

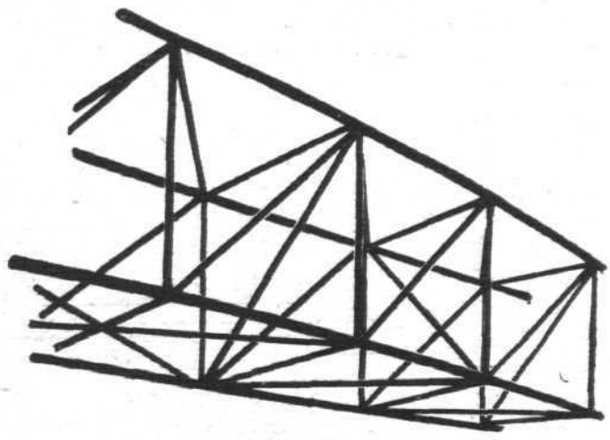


Fig. 18

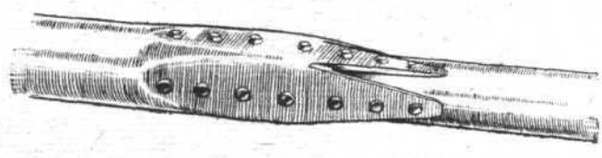


Fig. 19

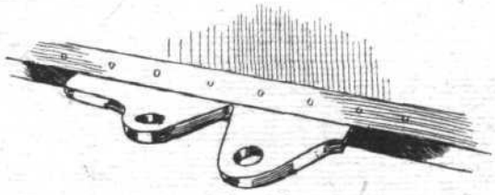


Fig. 14

by light wood stringers which pass from the end of the armoured portion to the front end of the tail skid.

The rear portion of the body is a structure of great strength. The vertical tubes in the last two bays before the stern-post are replaced by strong bulkheads of duralumin sheet. The construction is made clear in the drawing of the *fuselage*, which shows that the upper and lower *longerons* on each side are joined by duralumin sheet of channel section, which is wider at the middle than at either end. A rectangular sheet of corrugated duralumin is riveted on either side of the vertical channel girder, and inside the box thus formed are two stout duralumin tubes, the extremities of which carry bevelled steel collars similar to those on the ends of the wing spars. The

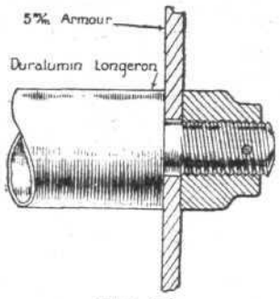


Fig. 20

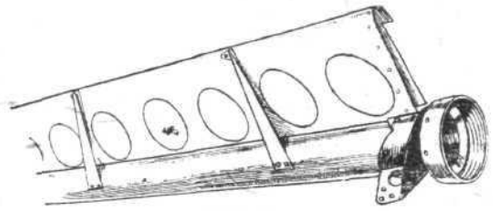


Fig. 21

space between the duralumin tubes and the front corrugated sheet is bridged by two duralumin channels, riveted at the front to the corrugated sheet, and at the rear to the tubes.

This construction is repeated in the next bay, and at the rear the pair of horizontal tubes are firmly attached to the sternpost. All six horizontal tubes are of equal length, and the exposed portions are covered by a flat duralumin sheet, as indicated.

It will be noticed that the *longerons* are not of the same diameter throughout, but are spliced towards the rear of the fourth bay (counting from the armoured portion). The character of the splice is precisely similar to that employed in the wing spars described above and illustrated in Fig. 19.

About 5 ft. from the sternpost the *fuselage* drawings indicate a kind of horizontal grid which is fixed to the lower *longerons*. This comprises a steel tube structure which takes no part in strengthening the *fuselage*, but is intended solely to provide handles for lifting the rear part of the body of the machine.

The two short tubes, shown in the side view, above and at each side of the handles are duralumin guides for the control cables.

The junction of the two parts of the *fuselage* is very simple. From the outside the *longerons* are seen to be butted up to the rear armour plate of the observer's cockpit, but no means of attachment is visible. Investigation from the interior of the cockpit shows that a substantial castellated steel nut is screwed over a steel bolt of about ½ in. diameter, and secured in place by the usual split pin. It was not possible to ascertain the exact manner of fixing the stud of the bolt into the end of the tubular *longeron*. Only the usual riveted steel collar to which the bracing tubes are riveted appears on the outside.

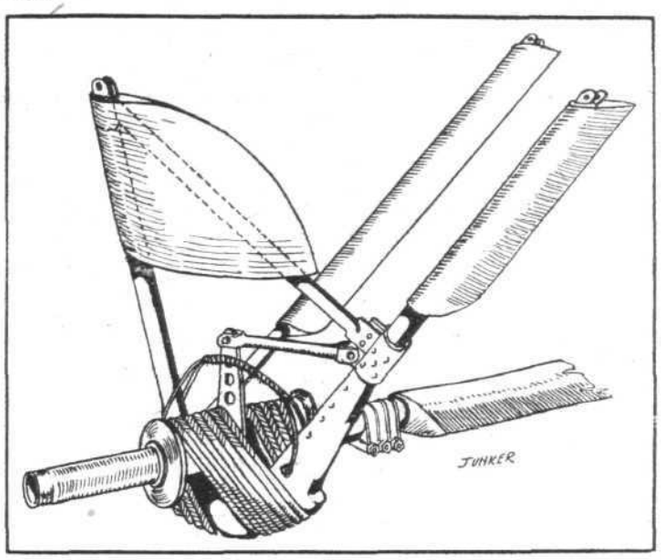


Fig. 22 "Flight" Copyright

The drawing (Fig. 20), shows the principle of this arrangement.

Undercarriage.

This is built to form one unit with the lower centre section. There are two vees which are of normal design, except that a supplementary tube is welded to the upper extremity of the forward limb and to a point just below the middle of the rear tube (*see* Fig. 22). The vees are parallel and vertical. The shock absorbing device—of which a sketch may be seen in Fig. 22—does not present any unusual feature. Twin coil spring is employed and a double loop of cable limits the upward travel of the axle, while a radius rod controls the movements of the axle. It will be noticed also from Fig. 33 that each vee is stayed by means of a steel tube, which connects the lower part of the front limb to the middle of the lower centre section, and that wire bracing is entirely absent.

The axle is a steel tube nearly 9 ft. long. In common with all other exposed tubes in the machine, it is faired with sheet aluminium, which is riveted to transverse webs (also of aluminium), which are in turn riveted to the axle tube. The fairing is, therefore, of the type that rises with the axle when the machine lands. There are no compression tubes fitted parallel to the axle, since the extra pair of tubes already mentioned render this unnecessary. Incidentally, they also eliminate wire-bracing. On other German aeroplanes which avoid wire wing-bracing (such as the D 7 Fokker and D 15 Pfalz) the undercarriage wires constitute the only external bracing.

(To be continued.)

◈ ◈

R.A.F. Aeroplanes Missing

THE Air Ministry regrets to announce that three aeroplanes which left Shotwick, near Chester, to fly to Baldonnel, near Dublin, on Saturday the 21st ultimo, are missing.

The machines left Shotwick at 2.6 p.m., and should have arrived at Baldonnel by 4.30 p.m. The pilots were Flying-Officer C. R. Pithey, D.F.C., Flying-Officer H. L. Holland, and Flying-Officer H. de W. Waller, all three experienced pilots. Flying-Officer Holland has made the trip previously.

The machines were fitted with wireless, and were tested by the pilots before leaving. The weather was reported favourable on both sides of the Irish Channel.

The machines started in formation. Flying-Officer Pithey leading, and were sighted between Denbigh and Rhyl shortly afterwards, but failed to arrive at Baldonnel. No further news was obtained until the morning of the 23rd ultimo, when a wireless message was received by the Admiralty from the master of the *Norfolk Range* dated the 21st ultimo, and reporting that an aeroplane had come down in the sea 85 miles S.W. of the Scilly Islands at 4.35 p.m. on that date. The message stated that the lifeboat was launched and every effort made to rescue the pilot, unfortunately without success owing to a rough sea and strong wind.

◈ ◈

Presumably this message refers to one of the missing machines, in which case it would appear that the pilot must have lost his way. No further news has yet been received of the two remaining pilots.

An American Height Record

AN amazing adventure marked the attempt of Maj. R. W. Schroeder, chief pilot at the McCook Aerodrome at Dayton (O.), to fly to a height of 40,000 ft. Maj. Schroeder had set out on his La Père (400 h.p. Liberty) and after climbing for two hours and five minutes, the oxygen apparatus ceased to function, apparently owing to its having been exhausted. Lifting his goggles to see whether he could set matters right, Maj. Schroeder must have been rendered unconscious, for the machine suddenly dived. When 2,000 feet from the ground the pilot partially regained consciousness, and was able to land the machine perfectly. When lifted from the machine, Maj. Schroeder collapsed and had to be taken to hospital. His eyes were frozen, but the doctors hope that his sight will not be permanently affected.

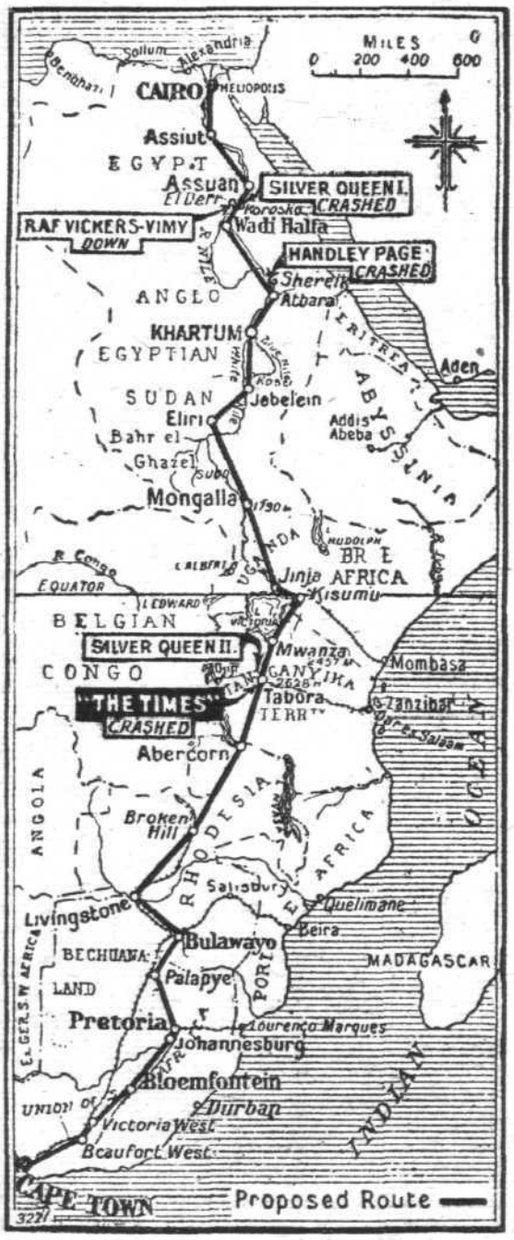
The barograph registered the greatest altitude attained as 36,020 ft., while the thermometers indicated a reading of 67° below zero (Fahr.).

THE FLIGHT TO THE CAPE

OF the four machines which were flying on the Cairo-Cape route last week, disaster overtook three, and at the time of writing (Wednesday), the Silver Queen II, the South African Government's Vickers-Vimy, is the only one left in the running, and she is making steady progress towards the Cape. The following is a brief summary of the happenings to the various machines during the past week :—

"The Times" Aeroplane

The Vickers-Vimy, with Dr. Chalmers Mitchell on board, left Kisumu at 6.50 a.m. on February 26 and reached Tabora



CAIRO–CAPE AIR-WAY: Map, reproduced from the "Times," showing the points reached by the various machines before they crashed, and the point reached at that time by "Silver Queen II"

at 12.30 p.m., the engines running fairly well with a lighter load, and it was hoped that the machine would thenceforward be able to make better progress.

On the next day, however, the starboard engine failed, just as the machine had reached flying speed, in taking-off from the Tabora aerodrome. The aeroplane crashed on the scrubs off the 'drome, settled on an anthill and almost turned over, both undercarriages being forced through the lower planes and tanks of the machine. Capt. Cockerell's wrist was sprained and Mr. Corby's leg was bruised, but otherwise the occupants of the machine escaped injury. The engines and propellers were undamaged, and arrangements were being made to store them. The cause of the crash was not ascertained, but it is believed that it was due to the rubber joint in a petrol-pipe giving way. The pilots and mechanics and Dr. Chalmers Mitchell have proceeded to Dar-es-Salaam whence they will return to England.

The "Silver Queen II"

In our last issue we recorded the arrival of the Silver Queen II at Khartoum ; it left there at 6.55 on the morning of February 25, and reached Mongalla the same evening. The machine left at 7.25 a.m. and arrived at Kisumu at 1.50 p.m. on February 26, left Kisumu (Victoria Nyanza) at 7 a.m. on February 27 and landed at Shirati at 8.30 on the same day. It left Shirati at 6.20 a.m. on February 28 and landed at Abercorn at 2.45 p.m. From Abercorn the Vickers-Vimy flew to N'Dola on February 29. The next morning it was away again at 5.45, landed at Broken Hill and reached Livingstone at 2.45 p.m.

The R.A.F. Vickers-Vimy

The R.A.F. Vickers-Vimy machine left Cairo on February 25 *en route* for the Cape. The crew consisted of Maj. Welsh, Capt. Halley and two mechanics. This machine was the standard Vickers-Vimy bombing type fitted with two Eagle VIII Rolls-Royce engines.

The object of the flight was primarily to report on the condition of the route, with a view to making recommendations as to its improvement and to gain experience from the Service point of view in long-distance flying.

Its start has been purposely delayed in order to give the other machines every opportunity to gain the honour of being first to traverse Africa by air.

The machine had to make a forced landing at Derawi, 20 miles north of Assuan, and it did not reach the latter place until 6 p.m. It left on February 27 at 8.5, and had to make a forced landing 80 miles north of Wady Halfa at El Derr on the Nile, near Korosko. It was then reported to be seriously crashed.

The Handley Page

This machine, which left Assuan on February 25, had to come down at Shereik, about two-thirds of the way to Khartoum. The machine was crashed beyond repair, but fortunately no one was hurt. The engines were undamaged. It being necessary to land, Maj. Brackley tried to reach an emergency landing-ground by means of a volplane from a height of 7,400 ft., but owing to the wind it was impossible to avoid the machine drifting.

The DH. 14 Machine

According to an official message from Rome the D.H. 14 machine, piloted by Mr. S. F. Cotton and Capt. Townsend, which was making for Cairo, *en route* for the Cape, had to make a forced landing at La Marinella, south of Sant' Eufemia (about 18 miles north of east from Messina). The members of the crew are safe, but the machine is damaged.

The Australian £10,000 Prize

ON the morning of February 25 Sir Ross Smith and his companions, on their Vickers-Vimy-Rolls, safely landed at Melbourne, and subsequently, at a reception at Parliament House, Mr. Hughes presented Sir Ross Smith with a cheque for £10,000. Mr. Hughes said the successful flight must surely convince the sceptics that in the near future there would be air routes used as regular channels of communication. Sir Ross Smith and his comrades were not only air pioneers but Empire builders.

It is stated that Sir Ross Smith and his brother, Sir Keith Smith, have decided that the two mechanics, Sergts. Shiers and Bennett, shall each receive £2,500 of the prize of £10,000.

Capt. Matthews' Progress

HAVING repaired the damage, to his Sopwith Wallaby, sustained in the crash of February 3, Capt. Matthews left Bandar Abbas last week intending to fly to Karachi. He got as far as Jask, Gulf of Oman, on the Persian coast, and in landing, damaged the chassis of the machine, which will mean another delay.

Lieut. Parer at Baghdad

THE De H. 9, piloted by Lieuts. Parer and Mackintosh, which left Hounslow on January 8 with the intention of flying to Australia, reached Baghdad on February 28. The pilots reported that they had to make a forced landing in the desert among hostile Arabs who were kept off by revolvers and Mills bombs. The machine, which left Brindisi on February 13, reached Athens during the afternoon. It flew to Crete on the 18th, and two days later crossed the Mediterranean, landing at Mersa Matruh. Cairo was reached the next day, and during the afternoon the machine flew on to Heluan. There the machine was overhauled, and it made another stage—to Ramleh—on February 26.

FLIGHT

ROYAL AERONAUTICAL SOCIETY NOTICES

Lectures.—At the meeting at the Royal Society of Arts at 8 p.m. on Wednesday, March 17, Maj. C. F. Abell, O.B.E., Associate-Fellow, will read a paper on "Airship Machinery, Past Experience, and Future Requirements." Col. The Master of Sempill, A.F.C., will take the chair.

Donations.—The Council desire gratefully to acknowledge the donation of sets of lantern slides for the Society's loan collection for the use of members from the directors of the National Physical Laboratory, Messrs. Vickers, Ltd., and Messrs. The British and Colonial Aeroplane Co., Ltd.

Annual Reports and Journals.—The following numbers of the early "Annual Reports" of the Society and of the *Journal* are missing from those available for sale. The Secretary would be glad to hear from any members who may have copies of these for disposal. Annual Reports for the years :—1865, 1867, 1874, 1877, 1883, 1884. Copies of the *Journal* for: October, November, December, 1918, and January, 1919.

Library.—The Library is now open every day, including Saturday, for the use of members from 9.30 to 5 p.m.

Annual General Meeting.—Notices convening the Annual General Meeting have been sent out for 5 p.m. on Tuesday, March 30, at the Society's offices, 7, Albemarle Street, W. 1. The retiring members of Council are: Mr. L. Bairstow, Mr. F. H. Bramwell, Maj. A. R. Low, Mr. H. White Smith, Dr. R. Mullineux Walmsley, Maj.-Gen. R. M. Ruck, Air-Commodore Bagnall Wild, Mr. R. V. Southwell, Dr. T. E. Stanton, Brig.-Gen. Sir Capel Holden, all of whom are eligible for re-election. Nominations for candidates for election to the Council, accompanied by a signification of willingness to serve, must be received by the Secretary not later than noon on Tuesday, March 9.

W. LOCKWOOD MARSH,
7, Albemarle Street, W. 1. Secretary.

CAMBRIDGE UNIVERSITY AERONAUTICAL SOCIETY

AT the meeting of the Society held on February 25, a lecture was given by Wing-Comdr. T. R. Cave-Brown-Cave, C.B.E., R.A.F., chief of the Airship Research Section, Air Ministry, on "Airship Development."

The lecturer explained the fundamental differences between the rigid and non-rigid type of airship, and sketched the development of these two classes from the airships in use at the outbreak of hostilities down to the large rigids of today. He discussed the use of the triangular keel which was incorporated in the first British rigid, R 9, and showed the various methods of suspending the car. In connection with this he explained the use of a water model, which is suspended upside down by rigging of the same design as is proposed for the actual ship. This is then filled with water and any defects in the rigging are immediately revealed by crumpling of the fabric.

Wing-Comdr. Cave-Brown-Cave said he could see no reason why the airship of the future should be limited with regard to size, except, when they became very large, there might be trouble caused by the excessive pressure of the gas bags on the bulkhead radial wires. He compared the essential qualities of airship with aeroplane engines, and said that in future engines must be specially designed and constructed for airship work; above all, the engines must come out of the ships easily for overhaul. The lecturer went very thoroughly into the question of fabrics and, explained the great advantages obtained by putting layers diagonally in ply-fabrics.

Much had been said of the great risk of fire in airships, but the lecturer said this was largely due to the petrol, and advocated the adoption of paraffin as soon as it was practicable.

Finally, he dealt with the commercial possibilities of airships, and said that in the long run they would prove much more popular than the aeroplane because a much higher degree of comfort could be obtained, and this, he maintained, was the factor of prime importance. The difficulty of having large numbers of men for mooring had been overcome by means of masts, in which case six men can easily moor the largest ships.

The development of airships has been, for the past five years, a matter of secondary consideration compared with heavier-than-air craft, and he recommended the whole question of lighter-than-air craft as a fertile field for exploration.

CORRESPONDENCE

[The Editor does not hold himself responsible for opinions expressed by correspondents. The names and addresses of the writers not necessarily for publication, must in all cases accompany letters intended for insertion in these columns.]

PARACHUTES

[2000] In a letter published in the issue of FLIGHT dated February 19, Maj. Orde Lees makes the incorrect statement that the "Guardian Angel" is the *only* type of "positive-opening" parachute with which human drops have been made.

After Maj. Orde Lees had joined the "Guardian Angel" staff to demonstrate that parachute in America, a series of deadweight trials were made which justified the "Salvus" for passenger use, and descents from aeroplanes with that parachute have since been made by Capt. Wilson, M.C.

Maj. Orde Lees expresses the opinion that a "breaking-cord," or its mechanical equivalent, connecting the top of the silk body to the aircraft in order to obtain what he terms "positive extension" is essential, but this would seem to be based rather upon personal predilection than scientific data in view of the fact that with a fall of 64 ft. and its resulting velocity of 64 ft. per second (even ignoring the horizontal velocity imparted by the aeroplane), a positive opening of only 2 sq. ft. will give a pull of about 20 lbs., which is more than the usual strength of attachment used to obtain "positive extension."

The claim that heavy stresses are necessarily developed when rigging is extended subsequent to inflation of the silk body is quite unjustified, as dynamometer tests prove that an extremely simple device can so eliminate these stresses that the shock of opening is reduced below the shock common on "positive-extension" parachutes, and this without any additional complication or increased weight of complete apparatus due to "shock-absorbers" such as is advocated to give the "positive-extension" type a chance to clear the aeroplane.

The open challenge issued by Maj. Orde Lees to put up a low-altitude record for human drop from aeroplane seems rather beside the mark, for hitherto this correspondence has dealt with comparisons of types of parachutes, and not with the relative intrepidity of individual parachutists. As Mr. E. R. Calthrop pointed out in his recent letter explaining the three fatalities that have occurred in demonstrations of the "Guardian Angel" parachute, tragic accidents may happen to experts jumping under selected conditions with an apparatus to which no blame can be imputed, and in a competition such as suggested it would seem that if two types were equally efficient the test altitude must be continuously reduced until one competitor were killed or maimed.

The most reliable test is undoubtedly to simultaneously drop from one aeroplane flying at a low altitude two equal weights respectively attached to the two competing parachutes, and to record the results by cinema camera and dynamometer, which are not liable to have their impressions or records affected by pulse, nerves or personal preference for one type of apparatus.

ERNEST E. SMITH, A.M.I.Mech.E.

Westminster, February 23.

FLYING AND CURIOUS PHENOMENA

[2001] Referring to the letter of Capt. Broad, published in your February 12 issue, I may say that I have already observed the same phenomenon. I found in the *Grande Encyclopédie*, heading "Arc-en-Ciel," the following explanation under the pen of Mr. A. Joannis :—

"When the sun is rather high above the horizon, the rainbows produced by reflection of the sunrays may figure complete circles. Sometimes it happens that the upper portion of these circles is absent, so that one sees a reversed rainbow."

The case is, consequently, not so much astonishing, as it has been recorded long before aerial exploration.

VTE. DE MAROLLES, Aé.C.F.-L.Aé.F.,
late Flying-Lieut. A.M.F.

Amiens, February 23.

AIRISMS FROM THE FOUR WINDS.

It is to be hoped that the "allégement" is true that officers of the Civil Aviation Department of the Air Ministry and Post Office experts are in consultation on the question of the inauguration of new international air mail services, and there is likely to be a considerable extension of the present facilities shortly, and a reduction in the scale of charges.

And about time, too—if anything comes of it. To a G.P.O. high official is attributed the following pronouncement:—"The Paris service was opened up for experimental purposes, and it has been a great success. Brussels and Amsterdam are the next most suitable termini, and sooner or later an air post is bound to be established in these places.

"The inauguration of an Italian service presents many difficulties, for there are the questions of night flying and the crossing of the Alps to be considered; but, as the capabilities of aircraft are developed, so will the international air routes be extended.

"As to the charges for letters, the rate of half a crown an ounce to Paris will shortly be reviewed, and I hope it will be possible to lower it."

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Possible! If it's only got as far as dawning upon high G.P.O. officials that it is *possible* to reduce the price of 2*s.* 6*d.* per oz., the immediate outlook is a sorry one. And why think in an ounce? Let the carrying companies have their head a bit, and let them carry "letters" at rates to be fixed by them from time to time, with a maximum, by way of formal protection, of the 2*s.* 6*d.* per oz. The P.O. could take their profit from a percentage of gross letter receipts. It could be left to the companies to see they made it pay, and we fancy that within a very short period the half-crown ramp would quickly get down to a paying rate that would encourage a vast freightage of letters to be sent by air, and at the same time a commercial air enterprise would be established, the end of which nobody can foresee. *Possible* lower charge than 2*s.* 6*d.* per letter! Great gootness, what imagination!

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Again aircraft has filled the void created by the French railway strike. And again the *Daily Mail* and *Times* organisations have led the way in the newspaper world by seeing that their papers were distributed to the South of France and other important centres by aeroplane. It has been a fine object-lesson, and, had the strike continued, the air-developments already maturing would have been quite startling to the unthinking crowd.

Without hesitation extra machines were put into service both from the London and Paris centres for helping anxious passengers and for urgent freightage. Down at Hounslow Aerodrome, Aircraft Transport and Travel, Ltd., were instantly ready to meet all rush requirements, triplicating and quadrupling their machines without the slightest fuss or bother. It was just a case of bringing out more of and the latest D.H.'s as fast as the situation demanded from hour to hour, as it were.

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From Paris Messrs. S. Instone and Co., of London and Cardiff, also helped in the emergency. They put on some of their London-Paris craft to work the Lyons-Riviera air-route, with highly successful results. Altogether, the strike, although of such short duration, has helped to emphasise the advantages of the air-route.

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The Gordon Bennett Aeroplane Cup does not look like being a "walk-over" for either Great Britain or France. Entries have been made by both America and Belgium for the prize.

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Admiral Pohl, one-time Chief of the German Admiralty Staff, during the first six months of the War, lets in a good deal of light upon the hopes and disappointments of the German Admiralty in those days, in the notes and letters just published by his widow. Needless to say, there are important references to the aerial side of the fleet movements and tactics. In these the Admiral condemns himself unmercifully in regard to responsibility for the raids upon London, etc., amongst other adventures set forth. Moreover, he categorically justifies the proceedings under war conditions. He also puts the Imperial Chancellor, Herr von Bethmann-Hollweg, in his place in this connection. The Chancellor, it would appear, was against these murderous proceedings from the first, and, by certain statements of Admiral Pohl, the Kaiser was also far from being an advocate of this line of argument. In fact, to those who are insistent upon placing the guilt of these raids upon Wilhelm, it might well appear as if the publication of the book might easily have for its chief object the whitewashing of the Kaiser for these happenings.

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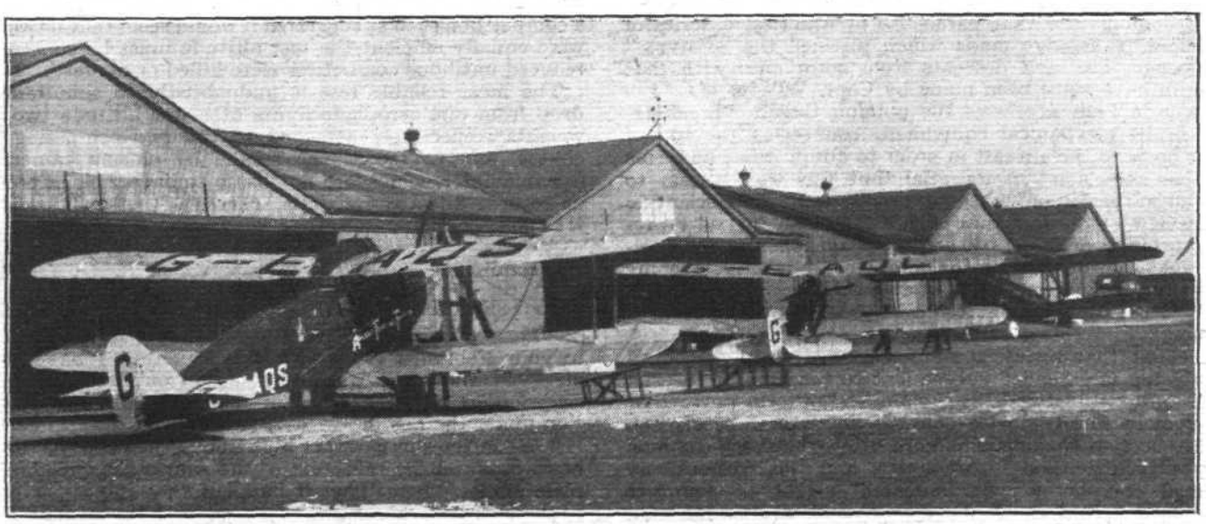
It was in the New Year of 1915 that the Admiral drew up his detailed memorandum on the new U-boat and air-raid campaign. On January 4 the completed document was first



HOUNSLOW–PARIS AIR SERVICE AND THE FRENCH RAILWAY STRIKE: A snap on Monday of extra machines being prepared by Aircraft Transport and Travel, Ltd., at Hounslow for the Paris service. The 'plane on the left is the latest D.H. 16, with Napier engine, which made its maiden voyage piloted by Mr. Courtney

shown to Admiral Tirpitz, who approved of it. On January 5 Admiral Pohl read it to the Imperial Chancellor, Herr von Bethmann-Hollweg, who demurred to the proposal that London should be attacked by air. In a letter to his wife, describing this conversation, Admiral Pohl explained :—" The Chancellor does not want an air campaign against London. I, for my part, want it, because the employment of our airships would otherwise represent too great a risk without any corresponding return. I said to him, ' Your Excellency, above all people, ought not to be against this proposal. The bombardment of London is permissible by international law ; yet you decline to permit it, although England is continually transgressing international law. The nation will not understand this.' He then told me that he would consider my statement. In other respects he approved of my memorandum."

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ON January 9 the Kaiser summoned Admiral Pohl to his personal headquarters at Charleville, in order to discuss the latter's Memorandum with him and with the Chancellor. General von Plessen, the Emperor's A.D.C., and Admiral Müller, of the Naval Cabinet, were the only other persons present at this interview, which lasted from 7 p.m. until 8.20 p.m. Admiral Pohl, writing to his wife, said :—" I once more developed my point of view, and then the Imperial Chancellor expressed his misgivings. I did not mince my words, but attacked the Chancellor, and urged that we ought not to treat England too timidly or show any mercy. I achieved a good deal as a result of this audience ; but his Majesty desires to spare London itself, because he considered it cruel to kill with bombs innocent women and children. In London only military works and the docks are to be dealt with."

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FOLLOWING certain U.-boat activities, the Kaiser is represented as having severely reprimanded Pohl for " making misrepresentations against his order," which had the effect of stopping the Admiral's U.-boat inclinations and reduced him to do his darndest with his airships. Therefore, on January 20, 1915, he first notes that a couple of Zeppelins had raided the East Coast of England. On April 14 the naval airship L.9 raided South Shields and Tynemouth, where 30 bombs were dropped. On August 9 he records the loss of L.12, shot down in the North Sea, and he notes that three other airships had bombed the Humber, Harwich and the Thames. One other airship had turned back earlier, owing to some defect. On the night of August 12-13 three out of four naval airships developed engine trouble, and had to turn back on their way to England ; the fourth raided Harwich. On August 17 the airships were out again. On October 13 all Admiral Pohl's airships were over London, and claimed that they had wrought extensive damage.

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OUR versions of these visits do not entirely coincide, but the point of view of Admiral Pohl appears to be set out with some conviction, and without doubt reflects what he honestly believed had happened. The work is a valuable contribution to the War literature which by degrees is seeing the light, and may help, with other documentary evidence, in clearing up many doubtful happenings during the most strenuous days of the War. The title of the book as published is " Aus Aufzeichnungen und Briefen während der Kriegszeit," von Admiral Hugo von Pohl, Chef des Admiralstabes und Flottenchef. (Karl Siegismund, Berlin.)

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ON April 1, when the whole of the German traffic system, including the air and automobile services, pass into the hands of the State, all the services and the railway administration are to be thoroughly overhauled. The air services are to be materially increased.

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IN the Church of St. Edmond the King with Nicholas Acons, Lombard Street, E.C., which was badly bombed in an air raid, a glass case has now been placed, containing all the recoverable pieces of the bomb.

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PERMISSION has been granted by the L.C.C. for the fixing to Hammersmith Bridge of a small brass or bronze plate, to commemorate the gallant act of Lieut. C. C. Wood, R.A.F., who leapt from the bridge and rescued a woman from drowning, afterwards dying of his injuries.

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LYONS Fair, which, in spite of the French railway strike troubles, was officially opened on March 1, looks like being a big success. Its importance more than justifies the inauguration of regular aeroplane services direct from Paris, Marseilles and even London.

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MR. F. J. MELVILLE states that the recent experimental aeroplane mail service between Tokyo and Osaka appears to have been a complete success, and the Japanese Department of Communications is losing no time in preparing to establish permanent and regular services of air mails in Japan. The proposed tariff for letters carried on this service is from 25 to 30 sen per 4 momme (15 grammes). It has not yet been decided whether special stamps will be issued to prepay these rates. There is a 25 sen denomination available in the current series, but if the rate be fixed at 30 sen a new stamp will be necessary.

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THAT Summer Time *is* to happen again—and, moreover, it looks as if it had come to stay.

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MR. J. H. THOMAS, M.P., is no laggard at advocating every issue that may benefit Labour. Therefore, it is well that every man in industry should read and ponder his latest pronouncement. Mr. Thomas's considered conclusions, referring to wages and prices, are that no greater mistake could be made by the working classes than to judge their standard of existence by the nominal wages that they drew. The vicious circle in which they were living must be broken. It would prove in the end disastrous both to the working classes and to the country as a whole to continue the system of getting more advances in wages for one section and artificially throwing up the cost of living for all. . . . . As long as this or any other Government continued to print mere paper money, not only would prices go up, but there would be no guarantee of any early reduction in the cost of living. They could not go on in the way they were going to-day, and to counteract the effect of the reduced value of the pound in America they must produce much more.

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A SIGN of the times is how aviation has affected the phraseology of meteorological reports and weather forecasts. It is seldom these appear now without degrees of " visibility " taking their place as a standard item.

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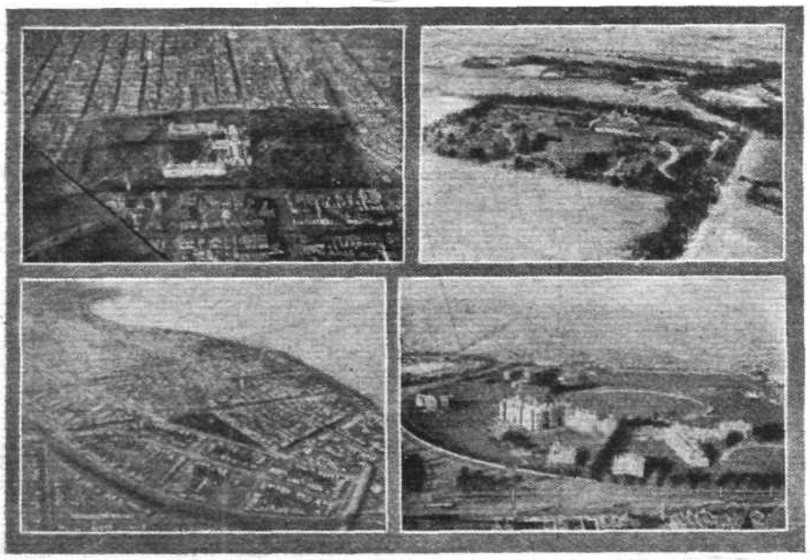
A VERY gay season is now in full operation in the Riviera. *In Portum Herculis*, according to one correspondent, seaplanes are plying for hire ! For 50f. or so you can take a " short spiral " and survey the Principality from the empyrean. Business seems brisk on fine days ; at times there are as many 'planes in the air as there be lizards on the garden terraces.

Pretty crowded air, we venture to suggest.



Snapshots secured over Melbourne some time ago by Major E. H. Reynolds from a military aeroplane.—(1) Exhibition Buildings ; (2) A country residence ; (3) Williamstown and surrounding district, showing entrance to River Yarra ; and (4) Melbourne University.

FLYING-BOATS:

The Form and Dimensions of their Hull

BY G. S. BAKER, Member*

Introductory

1. The subject of the Paper is one which in its infancy has been considered one of aeronautics only, but the passing of time is bringing it more and more into the realm of shipbuilding, and the knowledge and art of the shipbuilder are becoming a necessary adjunct to progress in flying at sea, and will become even more so as the flying-machine increases in size.

Before passing to the design of the flying-boat hull, it may serve a useful purpose if some reference is made to the development of speed both on the water and in the air, for progress in either of these may, and probably will, have a large effect upon commercial activity in the other. There is a fascination in speed which has been felt by mankind in all ages, and its attainment has always been and will continue to be the predominant element in sport. Any device or invention which has demonstrated its reliability in the sporting world as a speed producer is almost certain to find a place in the commercial world. For in all transit problems accepting reliability, the only test of any means of transport is :—" Can more profit be secured in this way than in some other way ? " Apart from commercialism, however, speed is of such strategic and tactical value, that, in recent years, it has been the leading consideration in many designs and types of ships. In the last 15 years the speed of all battleships has increased 25 to 40 per cent. ; the speed of submarines has doubled and destroyers can now do 40 knots. With increase in speed on the water, types have been developed which evade the most serious cause of resistance at high speed by so utilising the pressure in the water that the vessel is lifted to the surface and skims on the top. The racing motor-boat and the " coastal motor-boat " are of this type, and this will be the next step in destroyer design. When the resistance approximates to one-eighth the displacement it is a debatable question whether it is not easier to travel by air than by water. This is about the resistance of an air machine, and provided the necessary power can be installed and utilised in the machine, the air has several advantages over the water.

2. A flying-boat is essentially a flying machine for travelling over the water from port to port. It differs from the seaplane in having only one float which acts as a *fuselage* and to which are attached the main and tail air-wings. Compared with a land machine it has several advantages and disadvantages. Of the latter the chief are :—

(*a*) That it can only rise and settle on water and cannot be used for inland traffic unless there is a fair expanse of inland water. Several water machines have been built for this purpose, the Sopwith Bat Boat taking the Mortimer Singer prize in June, 1913, for getting off from the sea and coming down on land, and starting from land and alighting on the sea. There is little doubt that, in small machines at least, this difficulty could be overcome, if there was a real demand for an amphibious machine.

(*b*) Unless carefully designed it is a little slower in speed and cannot be put through the same stunt performances as a land machine. However, one of the most severe stunt tests is to loop the loop and a flying-boat designed by the Supermarine Aviation Co. was looped in 1918, the pilot being Capt. Goodwin.

(*c*) In all probability a flying-boat aerodrome would require a slightly larger staff, unless the boats are sufficiently seaworthy to remain anchored out in moderate weather. The importance of this factor diminishes with the increase in the size of aerodrome, and most of the types mentioned in the Paper have shown themselves capable of weathering severe sea conditions—in one case a prolonged gale on an open coast.

Against these have to be balanced the advantages :—

(1) The very serious difficulty with heavy land machines—the pressure on the chassis wheels—is entirely absent in flying-boats.

(2) It is not restricted to certain aerodromes for settling but can settle safely at any port required.

(3) The main use of aeroplane carriers in the immediate future will be on such trade routes as are not served by fast railways and as far as Great Britain is concerned, the trade routes to Scandinavia. The ports of Germany and America are almost entirely by water, and any machine not capable of settling on the water would hardly come up to accepted standards of safety on these routes.

This serious disability of land machines working on water routes was brought out strongly last summer by their failure to leave Newfoundland for many weeks, and the ease with which the American flying-boats left soon after their arrival. It has also been demonstrated since the Armistice by the loss of land machines in the English Channel and the Mediterranean.

3. Reliability of service is an essential for any transit service. On this matter the author is hardly in a position to make any authoritative statement. His own experience has been confined to experimental work for which fine weather was required, and he can only quote Mr. Holt Thomas, who states that it should be possible to obtain an 80 per cent. efficiency on the London–Paris route and the figures given in the *Daily Mail* Year Book which show a 96 per cent. efficiency for the six weeks, August 25 to October 4.

In some respects the paper is incomplete, but that is a necessity in dealing with a subject on which exact data is very scarce.

Flying-boat Hulls

4. In the course of the last seven years, several types of flying-boats have been designed and flown, but practically all of them are on the same general lines. Success in the hull design, however, depends on detail to a very large extent, and the purpose of the Paper is to bring out the essential factors and to show the effect of variation in certain features of design, as determined by tank and full-scale work.

A flying-boat hull replaces the carriage, body and *fuselage* of an ordinary land machine, and the main wing surfaces, and usually the tail wing system, are attached directly to it. The lower surface of the hull is of the hydroplane type, having a step in the bottom at or about the longitudinal position of the centre of gravity of the machine. As the hull carries the tail system it is made longer and finer than is necessary for either buoyancy or planing purposes. The planing surface of the forebody is usually made of greater beam than the body of the hull to secure a large planing area and buoyancy forward, without large weight of hull.

All modern flying-boats have a negative metacentric height when at rest, and require small floats to keep the wings from contact with the water. This is dealt with in Section 11.

5. *Dynamic Requirements of Hull.*—When the machine is flown from rest, like all other water vessels, its first tendency is to sink to a slightly lower level and to trim forward—the trim being increased a little by the high position of the propellers. Above 12 or 14 knots, it trims back and ultimately planes—usually at speeds varying from 18 to 24 knots according to loading. After the planing speed is reached, the stern trim either remains constant or slowly diminishes and from this stage onwards until the flying speed is reached the pilot can control the longitudinal inclination within certain limits. For good performance, therefore, three things are required :—

(*a*) Absence of diving or nosing under at any speed.

(*b*) Seaworthiness and absence of any tendency to leave the water before flying speed is reached, either by porpoising or bucking.

(*c*) Ability to change trim with reasonable control moment when near the flying speed, so that the machine can be held on or got off the water at any instant.

6. *Diving at Low Speed.*—This could easily be avoided by elongating the bow ; but a long bow is a serious objection in the air, as it adds unnecessary weight and tends to directional instability. Rapid changes of curvature of the planing bottom in the longitudinal direction should be avoided, the chine lifted gradually towards the fore end and the beam over chine maintained fairly full towards the bow. Under these circumstances diving will not show itself unless the hull is overloaded.

Seaworthiness and Porpoising.—At low or taxi speeds, the conditions are much the same as for motor-boats and to some extent must be met in the same way, by keeping the chine fairly high and full in plan at the fore end. The sections should be shaped to divide the water easily and beat it down, and for the latter require to have a reasonably flat surface on each side close to and beneath the chine. If the sections are made V in shape from middle line to chine, more spray is thrown up, and the steeper the V the higher the spray is

* A paper read before the North-East Coast Institution of Engineers and Shipbuilders, on Friday, February 27, 1920.

thrown. Working longitudinal ribands under the bottom had little or no effect on this spray, but similar ribands along the lower edge of the chine of a model having V sections reduced the spray a little, at and above the hump speed. Above taxi speeds and when accelerating to get off, many flying-boats if left to themselves will develop longitudinal oscillations, leading to the machine taking leaps off the water —a phenomenon usually called porpoising or bucking according to the type of oscillation. In some types which possess this defect it can be easily overcome by small and steady moments exerted by the elevator. The heavier the machine the more important are the stresses produced by the impact at the end of each leap, and the more objectionable does this feature become.

The longer porpoising is delayed, the greater is the damping effect of the wings and the more air control the pilot has over the machine while the possibility of checking any oscillation is also greater. True porpoising never develops in smooth water until the hull is planing cleanly, and where there is ample horse-power for propulsion, it is better to keep this minimum planing speed as high as possible. Reduction of depth of step to nil at the middle line, or increase in slant of cross sections near the step are both effective in this direction. Tank experiments have led to the development of several forms which do not porpoise at all, even on a choppy sea. These have two steps, kept as far apart as possible, the rear step being shaped to meet the water leaving the front step at a relatively small angle, the step being given a deep V for this purpose. These machines run at moderate speeds with water in contact with both steps and the hull between them. By far the major portion of the load is then taken on the fore-body, which is also responsible for nine-tenths of the water resistance. The after step is giving a little lift and serves to balance the tipping moment due to the fore-body and the slight suction developed between the two steps.

The centre of gravity should be at or abaft the step. There is no critical point in this connection, but the latter gives better results, and earlier porpoising has resulted in several cases by taking the centre of gravity of the machine forward.

7. *Change of Trim at High Speeds.*—It is desirable that a machine should be taken off the water soon after it has reached its minimum flying speed, so that the shape of the float must allow of the pilot trimming the machine back to the necessary angle without the tail hammering on the water, and this must be achieved without the use of excessive control moments.

If the hull is stable longitudinally it will have a natural running angle of its own, which is determined by the relative positions of the steps and tail until the getting-off speed is nearly reached, when the relatively greater air forces are the main factors in determining this angle (see also section 13). When the front step is on the water it leaves a shallow furrow in which the rear step or tail works, so that the longitudinal line joining the two steps is at a slight positive angle ; this is a rough criterion to the natural running angle of the hull. But change in shape of transverse section, particularly of the rear step, affects this to some extent, and experiments are required to determine it for any new type. When this is known the hull should be arranged on the machine so that the wing chords are at the angle for minimum flying speed when the hull is nearly at its natural running angle.

A machine in settling should always do so with stern trim. This ensures low flying speed, and first contact with the water on the second step, *i.e.*, aft the centre of gravity. Settling at small angles means water contact at high speed with a large area of bottom, and a possible awkward leap off the water. All modern flying-boat hulls have good restoring moments if held forward even to minus one or two degrees on the hull, but if the machine settles with the fore-body at negative angles of more than 3° or 4° (*i.e.*, the planing bottom at negative angles) the hull in some cases will not lift, but continues to enter the water or dive—leading to the breaking-up of the machine.

To ensure easy contact when settling on the water all large machines are formed with V or rounded sections below the chine line. First contact is then made on the keel, or ridge of the V at the first or second step and with average pilotage there is no shock. In the America and F types the angle of the V at the step varies from 145° to 160°. In later types such as the C.E. 1 the angle of the V *at the keel* is 130°, but taken from keel to chine is 147°. Both of these types have good reputations for settling. In recent designs of large boats the angle has dropped to 130°.

8. *Main Dimensions.*—It is of great importance that these should be as small as possible consistent with good design. A large hull has three objectionable features—greater (and useless) weight to be carried, greater air resistance, and lower centre of gravity.

The length from the centre of gravity to the tip of tail is fixed by aerodynamic requirements as the tail carries the tail fin and rudder system. The length forward of the centre of gravity should be the least possible consistent with good planing and reasonable seaworthiness. This has been determined in practice by experience, experiments in the tank being used to determine the comparative behaviour of any form when modified in this respect.

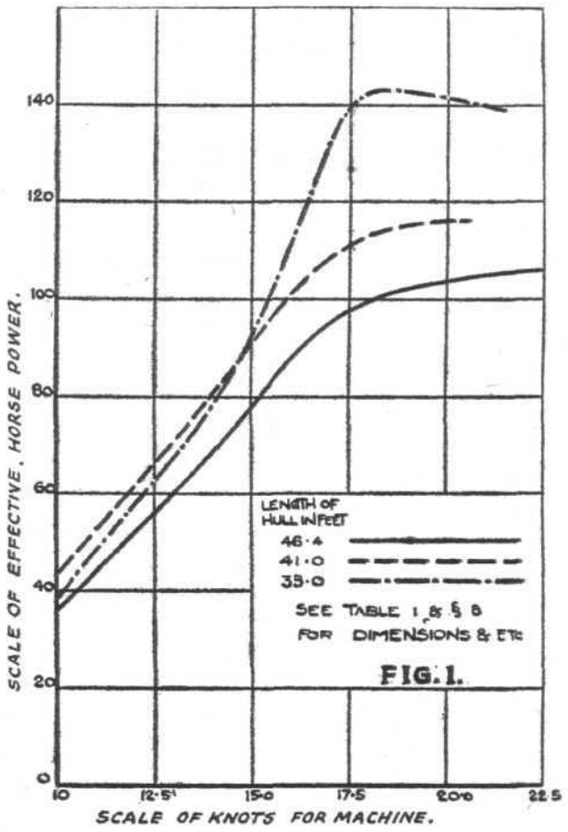


Fig. 1.—Effect of hull dimension on power required to overcome water resistance

Fig. 1 has been drawn to show the effect of increase in all dimensions of hull upon the horse-power required at low speeds up to the hump with a certain load (10,000 lbs.). As the larger hull will involve a greater weight, it has been assumed that the relative weight of hull varies as the total area of skin of vessel. Table I gives the dimensions, and weights so obtained. The smaller hull requires more power on the water near the hump speed, but the decrease in weight of hull is sufficient to compensate for the extra weight of engine required, and the weight is utilised for propulsion in the air instead of being mere dead-weight.

TABLE I.—*Comparison of Effect of Size for Constant Load*

Type 223 at 10,000 lbs. displacement.
61·3 knots minimum flying speed.

Stem to main step	·44 of length.		
Main step to second step	·22	,,	
Main step to tail	·56	,,	
C.G. of machine above bottom of forestep	8·2 ft.		
Propeller axis above bottom of forestep	13·2 ft.		
Length of hull (overall) in feet	35	41	46·4
Maximum beam—			
Over body in feet	4·28	5·0	5·65
Over chine in feet	6·0	7·0	7·9
Maximum E.H.P.	144	116·5	106
Speed for maximum E.H.P. in knots	19·0	20·0	20·5
Relative weight of hull—lbs.	425	580	750

9. The maximum loading which can be carried on a hull of the P 5 type has been determined by a series of model experiments. The lines and dimensions of this form, to carry 90,000 lbs. with a minimum flying speed of 50 knots, are given in Fig. 2. The horse-power to overcome the hull resistance, running angle, etc., are also given for this form in Fig. 3,

Better performances have been obtained as is detailed later, with modifications of the type, but only with sacrifice of load capacity. This is the best or optimistic load—not a design load—which can be carried in this hull, to give good results. For a displacement of 10,000 lbs. and the same flying speed, with one exception all the dimensions can be halved; but the fore-body length requires to be about 18 ft., *i.e.*, a little more than one-half, to give good results at low speeds.

When a hull is loaded to excess, it develops a tendency to wallow or nose under at speeds in the neighbourhood of 10 to 13 knots, and it is at these low speeds that the bad effect of loading is mostly felt. At higher speeds the wash thrown up from the chine of the fore-body increases in height with loading and may damage the propeller, if this happens to be in the line of the divergent wave. The hump speed and flying speed are both increased by loading, and the ratio of lift to resistance for any speed falls a little.

(To be continued.)

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A NIEUPORT NIGHTHAWK IN INDIA

FROM information recently to hand, it appears that the mission sent to India by the Nieuport and General Aeroplane Co. has accomplished good missionary work. Capt. Carroll, one of the Nieuport crack pilots, who was appointed to take charge of the enterprise, realised, soon after landing in India, that his work would be much more effective if he could demonstrate the quality of the Nieuport machines. He therefore cabled home for a Nighthawk two-seater to be shipped out to him at once, and he arranged to give a flying display in connection with the peace celebrations at Bombay on December 15. The machine actually arrived in Bombay on the s.s. *Gandara* on the morning of Sunday, December 14, the case containing it being swung ashore at once and unpacked. The parts were sent up by motor lorry to the Bombay Willingdon Club, and the mechanics, who had arrived with the machine, proceeded at once to the work of erection.

By 7 p.m., when work was suspended for the day, the work was nearly finished, and at 1.45 p.m. the next day everything was ready—the unpacking, erecting and rigging of the machine having been completed in 13 working hours. The preliminary test of the 320 h.p. A.B.C. Dragonfly engine having given satisfactory results, Capt. Carroll took his seat, and at 4.20 p.m. the machine rose from the Willingdon Club grounds. After a few evolutions, the Nighthawk went off in the direction of Bandra, Capt. Carroll releasing a shower of miniature souvenir aeroplanes *en route*. After his return to Willingdon, Capt. Carroll proceeded to Colaba, flying over the Oval, Fort, Apollo Bunder and the Causeway, causing immense excitement along the route among the great crowd that had turned out to see the flight.

On the following Sunday Capt. Carroll took a supply of the *Advocate of India* from Bombay to Poona, a large number of people congregating on the race-course at the latter place to give him a rousing welcome. He gave a display of aerial aerobatics at Poona in the evening, and returned to Bombay on the following Tuesday.

These flights have undoubtedly done a great deal of good in India, not only in demonstrating the airworthiness of the Nieuport machines in general and the Nighthawk in particular, but also in demonstrating the practical utility of the aeroplane as a means of transport.

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AERODROMES AND LANDING GROUNDS

THE Air Ministry announces that the following Notice to Airmen (No. 19) has been issued :—

The following aerodrome has been added to List B (Service Stations also available for Civil use) :

Aerodrome.	Nearest railway station.	Nearest town.
Northolt	Northolt Junction	London.

The following aerodrome has been deleted from List B, and is now shown in List D.1 :—

Aerodrome.	Nearest railway station.	Nearest town.
Castle Bromwich ..	Castle Bromwich	Birmingham.

The following aerodromes have been added to List C (Stations temporarily retained for Service purposes) :—

It should be assumed that no facilities usually exist at these stations for dealing with civil aircraft. The aerodromes, however, may be considered as emergency landing grounds.

Aerodrome.	Nearest railway station.	Nearest town.
Aldergrove	Aldergrove ..	Antrim.
Anglesey (A)	Llangefni ..	Llangefni.
Barlow (A)	Selby	Selby.
Chingford	Ponder's End ..	Chingford.
Inchinnan (A and A)	Honston	Glasgow.
Longside (A)	Longside ..	Peterhead.
Luce Bay (A and A)..	Stranraer ..	Stranraer.
Mullion (A and A) ..	Helston	Falmouth.
Pembroke (A and A)	Pembroke ..	Pembroke.
Shoreham	Shoreham ..	Shoreham-by-Sea.
Tadcaster	Thorrer	Tadcaster.

The following aerodromes have been deleted from List C :—

Aerodrome.	Nearest railway station.	Nearest town.
Bracebridge	Boolthan ..	Lincoln.
Dover (Swingate) ..	Dover	Dover.
Driffield (Eastburn) ..	Driffield	Driffield.
Hailing Road ..	Hailing Road ..	Thetford.
Montrose	Montrose.. ..	Montrose.
Northolt	Northolt Junction	London.
North Weald Bassett	Epping	Epping.
Scampton	Lincoln ..	Lincoln.
Sutton's Farm ..	Hornchurch ..	Romford.
Waddington ..	Waddington ..	Lincoln.

References : (A) Airship stations ; (A and A) Airship and aeroplane ; (A and S) Aeroplane and seaplane stations.

The following aerodrome has been added to List D.1 :—

Licensed Civil Aerodromes.

Aerodrome.	Nearest railway station.	Nearest town.
Castle Bromwich (X)	Castle Bromwich	Birmingham.

Reference : (X) No facilities exist at present.

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Summer Time in France and Algeria

THE Air Ministry has issued the following Notice to Airmen (No. 20) :—

"Summer time, by which the clock is advanced one hour, came into force in France and Algeria on February 15.

"Normal time will be resumed at midnight on October 25-26, or such date as may be notified.

"Meteorological forecasts will be issued in France at 8.45 a.m. and 12.30 p.m. (French time), corresponding with 7.45 a.m. and 11.30 a.m. Greenwich Mean Time."

'Ware Orford Island

THE Air Ministry announces that, owing to bomb-clearing operations, that portion of Orford Island lying between the sea and a line of warning notice-boards placed practically parallel to the coast-line and approximately 1,000 yards from it is highly dangerous.

All persons are hereby warned that this area should be carefully avoided, and that anyone trespassing thereon does so entirely at his own risk.

Retired Naval Officers and R.A.F. Rank

APPROVAL has been given for officers of the Royal Navy and Royal Marines, the R.N.R., and the R.N.V.R., who return to naval duty from the R.A.F. in a lower relative rank from that held in the R.A.F., to be given permission to resume their R.A.F. rank on retirement should they desire to do so. Application in each individual case must be made to the Admiralty.

The arrangement now sanctioned in the case of those who return to the Navy in no way affects the assessment of retired pay or gratuity, or of any pay, pension, emolument, or allowance payable from naval funds. The Admiralty will still retain the first claim to the services of an officer whose retired pay or gratuity is a charge on naval funds.

New French Military Aeronautics Chief

GEN. DUMESNIL, who has been appointed Director of Military Aeronautics in France, was originally an artillery officer. He held several important positions during the War, and was promoted to command a brigade in March, 1918.

FLIGHT

THE ROYAL AIR FORCE

London Gazette, February 20

Administrative Branch

The following relinquish their temp. R.A.F. commns, on return to Army duty :—Pilot Officer (Hon. Flight-Lieut.) C. J. P. Copner (Capt., S. Wales Bord.); Nov. 1, 1919 (substituted for notification in the *Gazette* of Nov. 25, 1919). Flight-Lieut. C. H. Frazier, M.C. (Qr.-Mr. (Capt.), Manch. R.); Jan. 14. Flying Officer E. P. Watson (Lieut., R.W. Surr. R.); Feb. 11.

(Then follow the names of 22 Officers who are transfd. to the Unemployed List under various dates.)

The notification in the *Gazette* of April 8, 1919, concerning Sec. Lieut. A. Anderson, is cancelled.

The notification in the *Gazette* of June 20, 1919, concerning Sec. Lieut. (actg. Lieut.) S. S. Vanderhook, is cancelled (notification in the *Gazette* of May 30, 1919, to stand).

Technical Branch.

Capt. F. B. Pulham, O.B.E., is graded for the purposes of pay and allowances as Maj. whilst employed as Maj., Grade (A), from May 1, 1919, to Sept. 19, 1919.

Sec. Lieut. to be Lieuts. :—F. G. Brockman; April 16, 1918 (since granted permanent commn.). W. A. Winter; June 2, 1918 (notification in *Gazette* of Feb. 24, 1919, to stand).

Sec. Lieuts. to be Lieuts., without pay and allowances of that rank :—J. L. Miles; April 2, 1918 (since granted short service commn.) (notifications in previous *Gazettes* to stand). J. C. Corbin; Mar. 21, 1919 (since demobilised) H. W. W. Hatch, W. E. Hunt (since demobilised); May 8, 1919. H. G. Short; June 3, 1919.

(Then follow the names of 14 officers who are transfd. to the Unemployed List under various dates.)

The notification in the *Gazette* of Jan. 27 concerning Lieut. R. F. Rowbottom is cancelled.

The notification in the *Gazette* of April 8, 1919, concerning Lieut. (actg. Capt.) J. B. Crabb, is cancelled (notification in the *Gazette* of Mar. 28, 1919, to stand.

Medical Branch.

The following are transfd. to the Unemployed List :—Capt. G. Meadows; Jan. 23. Lieut. T. E. Roberts; Jan. 27.

Memoranda.

P.F.O. F. N. Lawler is granted hon. commn. as Sec. Lieut.; June 20, 1919.

(Then follow the names of 3 Cadets granted hon. commns. as Sec. Lieuts.)

Group Capt. E. L. Gerrard, C.M.G., D.S.O., is placed on half-pay list; Feb. 17.

The following relinquish their temp. R.A.F. commns. on return to Army duty :—Squad.-Leader R. H. Howell (Maj., 15th Lrs., I.A.); Jan. 17. Wing Comdr. R. B. Martyn, M.C. (Capt., Wilts. R.); Feb. 11.

One Officer transfd. to the Unemployed List, from (S.O.); Nov. 1, 1919.

The notification in the *Gazette* of Feb. 25, 1919, concerning Sec. Lieut. H. H. Williams, is cancelled.

London Gazette, February 24.

The following temp. appointment is made :—

Staff Officer, 3rd Class.—(Q.)—Flight-Lieut. H. E. P. Wigglesworth; Feb. 11.

The following temp. appointment is made :—

Staff Officer, 3rd Class.—(P.)—Capt. W. C. Clark; May 24.

Flying Branch.

Sqdn.-Leader C. H. K. Edmonds, D.S.O., O.B.E., is restored to fall pay; Feb. 16.

Flight-Lieut. J. B. Cole-Hamilton to be Flight-Lieut. (A.1 Shp.), from (S.O.); Feb. 16.

Sec. Lieuts. to be Lieuts. :—(Hon. Lieut.) R. A. Brunton; Aug. 2, 1918 (since granted short service commn.). (Hon. Lieut.) J. Clarke, M.C.; Aug. 26, 1918 (since demobilised). Hon. (Lieut.) A. H. Darnbrough; Oct. 1, 1918. (Hon. Lieut.) J. S. Fletcher-Watson; Oct. 3, 1918 (since granted short service commn.). P. W. Adams; April 12, 1919. H. E. King (since granted permanent commn.), J. W. F. Merder (since granted short service commn.); June 6, 1919. E. E. Bricknell; June 20, 1919. W. McGowan; June 30, 1919 (since granted short service commn.).

The following relinquish their temp. R.A.F. commns. on return to Army duty :—Lieut. J. W. Shaw (Lieut., Oxf. and Bucks. L.I.); July 23, 1919 (substituted for notification in the *Gazette* of Sept. 16, 1919). Flying Officer W. C. L. O'Carroll (Lieut., R. Ir. Regt.); Nov. 13, 1919. Flight Lieut. A. G. A. Davis, A.F.C. (Lieut., Devon. R.); Feb. 5. Flying officer E. M. Drummond (Lieut., the Black Watch); Feb. 16. Flying officer S. W. Griffiths (Lieut., Ches. R.); Feb. 17.

Lieut. G. W. T. Garrood, A.F.C., re inquishes his commn. on ceasing to be employed, and is permitted to retain his rank; Dec. 20, 1919.

The following Lieuts. relinquish their commns. on ceasing to be employed :—G. M. Dean, M.B.E. (Lieut., Can. F. Art.); Dec. 30, 1918. C. M. McCann (Lieut., Can. M.G. Corps); March 16, 1919. J. T. Anglin (Capt., C. Ont. R.); Mar. 31, 1919. Lieut. M. R. D'Arcy; Feb. 21.

(Then follow the names of 61 officers who are transfd. to the Unemployed List under various dates.)

Sec. Lieut. J. W. R. Newson relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain his rank; Feb. 17.

Sec. Lieut. R. C. Van der Ben, M.C., D.F.C., is antedated in his appt. as Sec. Lieut. (O.); Aug. 8, 1918.

The surname of Lieut. D. J. Allan (Manitoba R.) is as now described and not as stated in the *Gazette* of July 1, 1919.

The initials of Lieut. K. D. MacPherson are as now described, and not as stated in the *Gazette* of Jan. 20.

The initials of Lieut. J. K. Finlay are as now described, and not as stated in *Gazette*, Nov. 4, 1919.

The notification in *Gazette*, April 1, 1919, concerning Lieut. H. W. Underhill is cancelled (notification in *Gazette*, May 6, 1919, to stand).

The notification in *Gazette*, April 11, 1919, concerning Sec. Lieut. C. H. Booth is cancelled.

The notifications in *Gazettes*, April 26, 1918, and May 7, 1918, concerning Lieut. G. G. Crutchley are cancelled.

The notification in *Gazette*, June 13, 1919, concerning Sec. Lieut. G. Roberts is cancelled (notification in *Gazette*, April 25, 1919, to stand).

The notification in *Gazette*, Dec. 31, 1918, concerning Sec. Lieut. G. W. Waddington is cancelled

The notification in *Gazette*, Jan. 20, concerning Sec. Lieut. P. A. Kingsland is cancelled.

The notification in *Gazette*, Nov. 18, 1919, concerning Lieut. M. B. Lewis is cancelled (notification in *Gazette*, Nov. 21, 1919, to stand).

The notification in *Gazette*, Dec. 12, 1919, concerning Lieut. H. S. Broughall, M.C., is cancelled.

The notification in *Gazette*, Jan. 6, concerning Lieut. G. W. T. Garrood, A.F.C., is cancelled.

The notification in *Gazette*, July 15, 1919, concerning Sec. Lieut. D. H. Houston is cancelled.

The notification in *Gazette*, July 18, 1919, concerning Capt. J. H. Tyler M.B.E., is cancelled.

The notification in *Gazette*, Feb. 3, concerning Lieut. L. E. G. Hawkin s cancelled (notification in *Gazette*, Jan. 30, to stand).

Administrative Branch

Flight Lieut A. H. Stradling, O.B.E., to be Flight Lieut., from (S.O.); Feb. 14.

Sec. Lieut. F. A. Osborn to be Sec. Lieut., from (T.); June 23, 1919, and is graded for purposes of pay and allowances as Capt. while employed as Capt., from June 23, 1919, to Sept. 26, 1919.

Flying Officer A. W. Symington, M.C., to be Flying Officer, from (S.O.); Feb. 16.

Second Lieutenants to be Lieutenants.—(Hon. Capt.) R. Blackith; April 2, 1918. E. J. Munson; June 5, 1919 (since granted short service commn.) (previous *Gazette* notices to stand).

Sec. Lieut. F. A. Osborn is graded for purposes of pay and allowances as Lieut. while employed as Lieut., from May 1, 1919, to June 2, 1919.

Lieut. H. A. de F. Furber (Capt., R.W. Kent R.) relinquishes his commn. on ceasing to be employed, and is granted rank of Capt.; Sept. 24, 1919.

Lieut. W. H. Osman relinquishes his commn. on ceasing to be employed, and is granted rank of Major; Feb. 1.

(Then follow the names of 15 officers who are transfd. to the Unemployed List under various dates.)

The initial of Sec. Lieut. T. Mann is as now described, and not J. Mann, as stated in the *Gazette* of Jan. 20 (page 839).

The notification in the *Gazette* of Nov. 21, 1919, concerning Sec. Lieut. W. A. Wright is cancelled.

The notification in the *Gazette* of Oct. 24, 1919, concerning Lieut. (Hon. Capt.) H. A. de F. Furber is cancelled.

The notification in the *Gazette* of April 1, 1919, concerning Lieut. (acting Capt.) H. Jackson is cancelled.

The notification in the *Gazette* of Feb. 6, concerning Capt. A. W. Crombie is cancelled (notification in the *Gazette* of Feb. 13, to stand).

Technical Branch.

Lieut. F. Thomas is graded for purposes of pay and allowances as Capt. while employed as Capt., Grade (A); April 1, 1919 (substituted for notification in the *Gazette* of Nov. 4, 1919).

Pilot Officer F. A. Osborn to be Pilot Officer, Grade (B), from (Ad.); Nov. 21, 1919, and is graded for purposes of pay and allowances as Flight Lieut. while employed as Flight Lieut., Grade (B), from Nov. 21, 1919, to Feb. 7.

Lieut. F. Thomas is graded for purposes of pay and allowances as Lieut. while employed as Lieut., Grade (A), from Feb. 10, 1919, to March 31, 1919 (substituted for notification in the *Gazette* of Nov. 4, 1919).

Flying Officer A. J. Somers to be Flying Officer, Grade (B), from (S.O.); Nov. 14, 1919 (substituted for notification in the *Gazettes* of Jan. 20 and Feb. 10).

(Then follow the names of 64 officers who are transfd. to the Unemployed List under various dates.)

Lieut.-Col. W. E. Jones (L'pool R. (T.F.)) relinquishes his commn. on account of ill-health, and is permitted to retain his rank; Mar. 5, 1919 (substituted for notification in the *Gazette* of Mar. 4, 1919).

Lieut. D. P. Glazer relinquishes his commn. on account of ill-health contracted on active service, and is permitted to retain his rank; Oct. 5, 1918 (substituted for notification in the *Gazette* of Oct. 4, 1918).

Sec. Lieut. H. C. Coutts relinquishes his commn. on account of ill-health, and is permitted to retain his rank; Feb. 17.

The initials and surname of Sec. Lieut. A. M. W. Leyfield are as now described and not as stated in the *Gazette*, of April 1, 1919.

The notification in *Gazette*, Mar. 21, 1919, concerning Sec. Lieut. R. M. Brown is cancelled.

The notification in *Gazette*, Aug. 29, 1919, concerning Lieut. R. Leedal is cancelled (notification in *Gazette*, Aug. 19, 1919, to stand).

Medical Branch.

Flying Officer G. McK. Thomas to be Flight Lieut.; Feb. 12.

(3 officers transfd. to the Unemployed List.)

Dental Branch.

(2 officers transfd. to the Unemployed List.)

Memoranda.

(2 overseas Cadets granted temp. commns. as Sec. Lieuts.)

The following Prob. Flight Officers are granted hon. commns. as Sec. Lieuts. :—D. B. Gush; Feb. 1, 1919. W. Dickinson; Mar. 10, 1919. G. R. Geering; Mar. 13, 1919. R. E. Greenwood; Mar. 21, 1919. H. G. G. Green; Mar. 31, 1919.

The following Sec. Lieuts. relinquish their commns. on ceasing to be employed, and are permitted to retain their rank :—A. J. Bergeron, H. A. Boyd, R. H. B. Cook, M. Crandall, E. A. Ritchie; Mar. 28, 1919.

Capt. M. McK. Wood, O.B.E., relinquishes his commn. on being elected M.P.; April 30, 1919 (substituted for notification in *Gazette*, Aug. 15, 1919).

(5 officers transfd. to the Unemployed List.)

The notification in *Gazette*, Dec. 2, 1919, concerning Capt. J. H. Tyler, M.B.E., is cancelled.

The notification in *Gazette*, Aug. 29, 1919, concerning Sec. Lieut. E. Parkinson is cancelled.

London Gazette, February 27.

The following temp. appointment is made :—

Staff Officer, 3rd Class (P.).—Flying Officer (Hon. Flight Lieut.) J. P. Walters; Aug. 5, 1919.

Flying Branch.

Sec. Lieut. L. E. Falla (late Gen. List, R.F.C., on prob.) is confirmed in rank as Sec. Lieut. (A.); July 8, 1918.

Canadian Cadet C. A. McKinnon is granted a temp. commn. as Sec. Lieut. (A.); Oct. 17, 1918.

The following relinquish their temp. R.A.F. commns. on return to Army duty :—Lieut. J. W. Warren (Lieut., Canadians); Feb. 6, 1919. Flying officer G. L. Castle (Lieut., R.F.A.); Jan. 9.

The notification in the *Gazette* of Feb. 17 concerning Sec. Lieut. W. McKay is cancelled.

Lieut. B. Stefanson (Lieut., Sask. R.) relinquishes his temp. R.A.F. commn. on return to Canada; Jan. 31.

Married

FRANCIS CAMPBELL BROWN DOUGLAS (late Capt., Rifle Brigade, and R.A.F.), son of Mr. and Mrs. C. C. Brown Douglas, of St. James's Court, Buckingham Gate, London, was married on February 17 at St. George's Church, Stockport, to DORAH BEVAN NIXON, elder daughter of Mr. and Mrs. GEORGE NIXON, of Hope Range, Davenport, Stockport.

Lieut. AYLMER STEWART MEYRICK MEYRICK-JONES, A.F.C., R.G.A., son of the late Dr. A. Meyrick-Jones, F.C.S., M.D., was married on February 21, at St. Philip's Church, Kensington, to EMILY VIVIEN, only daughter of Maj. T. W. G. BRYAN, late R.G.A., and Mrs. Bryan.

Capt. CEDRIC NEVILL JONES, R.F.C., late of the Sherwood Foresters, only son of the late Mr. Alfred G. Jones (China) and of Mrs. Jones, of Elmhurst, Derby, was married on February 17 at Christ Church, Lancaster Gate, to DOROTHY MAY LOUISE STAFFORD, elder daughter of the late Mr. George M. Stafford, of Sydney, Australia, and of Mrs. Stafford, 68, Holland Park Avenue, W.

To be Married

The engagement is announced between JOHN CROCKER BULTEEL, R.A.F., son of the late Percy F. Bulteel and of Mrs. Matthews, of Ellensleigh, Elburton, Plymouth, and MARGERIE FRANCES GORDON, second daughter of the late Alexander Gordon, of Delamont, Killyleigh, Co. Down, Ireland, and of Mrs. Gordon, of Bidna, Northam, Devon.

The engagement is announced between Maj. V. W. EYRE (late R.A.F.), son of the late Capt. V. T. Eyre, of Lindley Hall, Leicestershire, and of Mrs. Eyre, of 46, Egerton Crescent, and ESMÉ, second daughter of the late Capt. CUTLAR FERGUSSON (Scots Guards), of Craigdarroch.

The engagement is announced between Mr. GUY FFISKE (late R.A.F.), son of Mr. Henry ffiske, of Holm Close, Brundall, Norfolk, and CONSTANCE EIRENE OGSTON, daughter of Sir Alexander Ogston, K.C.V.O., of Glendavan, Dinnet, Aberdeenshire.

The engagement is announced between Flight-Lieut. C. H. B. JENNER-PARSON, R.A.F., younger son of the late Charles Jenner-Parson, M.D., of Godalming, and VIOLET, only daughter of the late R. H. MACKWORTH-PRAED, of Mickleham Downs, Surrey.

The engagement is announced between Capt. IAN MCLAREN, R.A.F., the Inter-Allied Aeronautical Commission of Control, Berlin, son of Mr. Thomas Stothert McLaren, of Johannesburg, South Africa, and SIDNEY MARY, eldest daughter of Mr. and Mrs. THOMAS MARLOWE, Longmead, Champion Hill.

The engagement is announced between RICHARD KEITH VAN SICKLE (late R.A.F.), eldest son of Mr. and Mrs. R. van Sickle, of Keith House, Biddenham, Bedfordshire, and Ploesti, Rumania, and SYLVIA MARY, younger daughter of Sir WALTER and Lady SHAKERLEY, of Somerford Park, Congleton, Cheshire.

The engagement is announced between J. B. SOLOMON (late Maj., Oxford and Bucks Light Infantry and R.A.F.), eldest son of Mr. and Mrs. Bernard Solomon, of 2, Aubrey Road, Campden Hill Square, W., and RUTH EVELYN, younger daughter of the late HERMANN H. MYER and Mrs. MYER, of 95, Oakwood Court, Kensington.

THE engagement is announced between A. DENIS TATHAM (late Black Watch, attd. R.F.C.), younger son of Mr. and Mrs. C. E. Tatham, of Edinburgh, and STELLA MARY, elder daughter of Mr. and Mrs. WALTER POWLES, of Ardmore, Ealing.

Item

The will of Mr. ELLIS ELIAS, of Cromwell Road, Kensington, S.W., chairman of the British Oxygen Co., Ltd., and a director of the United Railway and Trading Co., Ltd., has been proved at £38,704.

AVIATION IN PARLIAMENT

Frieston Aerodrome, Lincolnshire

MR. ROYCE on February 23 asked the Under-Secretary of State for Air whether he is aware that the Freiston Aerodrome, Lincolnshire, occupies 90 acres of the most highly-productive agricultural land in the country; that seven tenants of this land are dispossessed of their respective holdings to their great financial loss; that the buildings, hangars and other erections at the aerodrome have been greatly damaged by recent gales, and now lie in ruins; that, though there has been no recent flying from this station, considerable expenses are still incurred; that heavy lorries are continually coming and going, doing serious damage to the roads; and whether it is in the national interest that this station be closed and the land handed back to the former tenants?

Maj. Tryon: The reply to the first part of the hon. member's question is that the Frieston Aerodrome occupies approximately 90 acres of productive agricultural land, though I am not in a position to compare it with other land in the country as regards productivity; to the second part, that the tenants referred to are receiving compensation on a basis agreed with them in 1916; to the third part, that the recent gales caused damage to the Bessonneaux hangars only and not as stated by him; and to the fourth part, that expenses have been incurred owing to the change over from a war to a peace basis, and a small staff has necessarily been employed there in connection with this work. The heavy traffic referred to in the fifth part has been caused by the change over and the consequent removal of stores, etc. Any damage to the roads resulting therefrom will be dealt with by the Joint Roads Board. The reply to the last part of the question is in the negative, as this is one of the aerodromes selected as a permanent station for the R.A.F. on account of the exceptional facilities it provides for certain branches of training, facilities which I am advised it is difficult to obtain elsewhere in the British Isles.

School of Music

MR. CAUTLEY asked the Under-Secretary of State for Air the total cost to the nation of the R.A.F. School of Music since its institution to the latest convenient date; when did it commence operations; what is its present personnel; does it serve any useful purpose; and whether he will consider the desirability, in the public interest, of forthwith closing it?

Maj. Tryon: I regret that, in the time available, I am not able to reply to the first part of my hon. friend's question. As soon as I receive the information I will communicate with him. The reply to the second part of his question is July, 1919; to the third, two officers and 45 other ranks; to the fourth, in the affirmative; and to the fifth, that I see no reason why the R.A.F. should be deprived of advantages enjoyed by other branches of His Majesty's Service.

Central Mess Fund

LIEUT.-COL. BUCHANAN asked the Secretary of State for War whether he is aware that officers of the R.A.F. have been charged compulsorily the sum of one-third of a day's pay monthly towards the Central Mess Fund of that corps; under what authority this charge against officers has been made; and what are the purposes to which, and under whose control, these funds are being put?

Maj. Tryon: The statement in the first part of my hon. and gallant friend's question is substantially correct, in that a deduction of one day's pay a quarter, subsequently reduced to one day's pay a year, has in many cases been made from officers' pay in respect of the R.F.C. Central Mess Fund (now the R.A.F. Officers' Sports Fund). In regard to the second part, this fund was founded as a voluntary association by officers of the late R.F.C., primarily for the encouragement of sport, and what was originally a voluntary subscription became by custom a deduction from officers' accounts, subject to the right of officers to reclaim any moneys so deducted if they wished. Deductions ceased to be made from March, 1919. In regard to the last part of the question, the fund is now administered by an elected committee of five officers of the R.A.F., and will in future be utilised for the purpose of assisting and encouraging sport in the R.A.F.

Aeroplanes

MR. CAIRNS on February 25 asked on what date the Government of India made known their requirements for aeroplanes for military purposes; and on what date those requirements were supplied?

Mr. Fisher: In July and August, 1918, representations were made as to the need of additional air forces in India, but the requirements of the Western Front rendered it impossible to comply with the demand. In November, 1918, shortly after the Armistice, Air Vice-Marshal Salmond proceeded to India to confer on the post-War organisation and strength of the Royal Air Force in that country, but without waiting for a final decision on those points, additional air forces were demanded in January, 1919. It was accordingly arranged that additional air forces should be despatched to India, and that the squadrons already there should be re-equipped with up-to-date machines. Owing to the difficulty of providing suitable shipping, and to the shortage of personnel due to demobilisation, the reinforcements did not reach India until the late summer and autumn of 1919. These reinforcements fulfilled all requirements.

FLIGHT

ACCUMULATORS IN THE MAKING

A Visit to the "Exide" Factory

FROM the propulsion of submarines of the latest and most powerful type to that of small model aeroplanes! It is a long metaphorical bridge that must span such a gap, but not so long but that it is within the purview of a single firm—the Chloride Electrical Storage Co., Ltd., of Clifton Junction, Manchester.

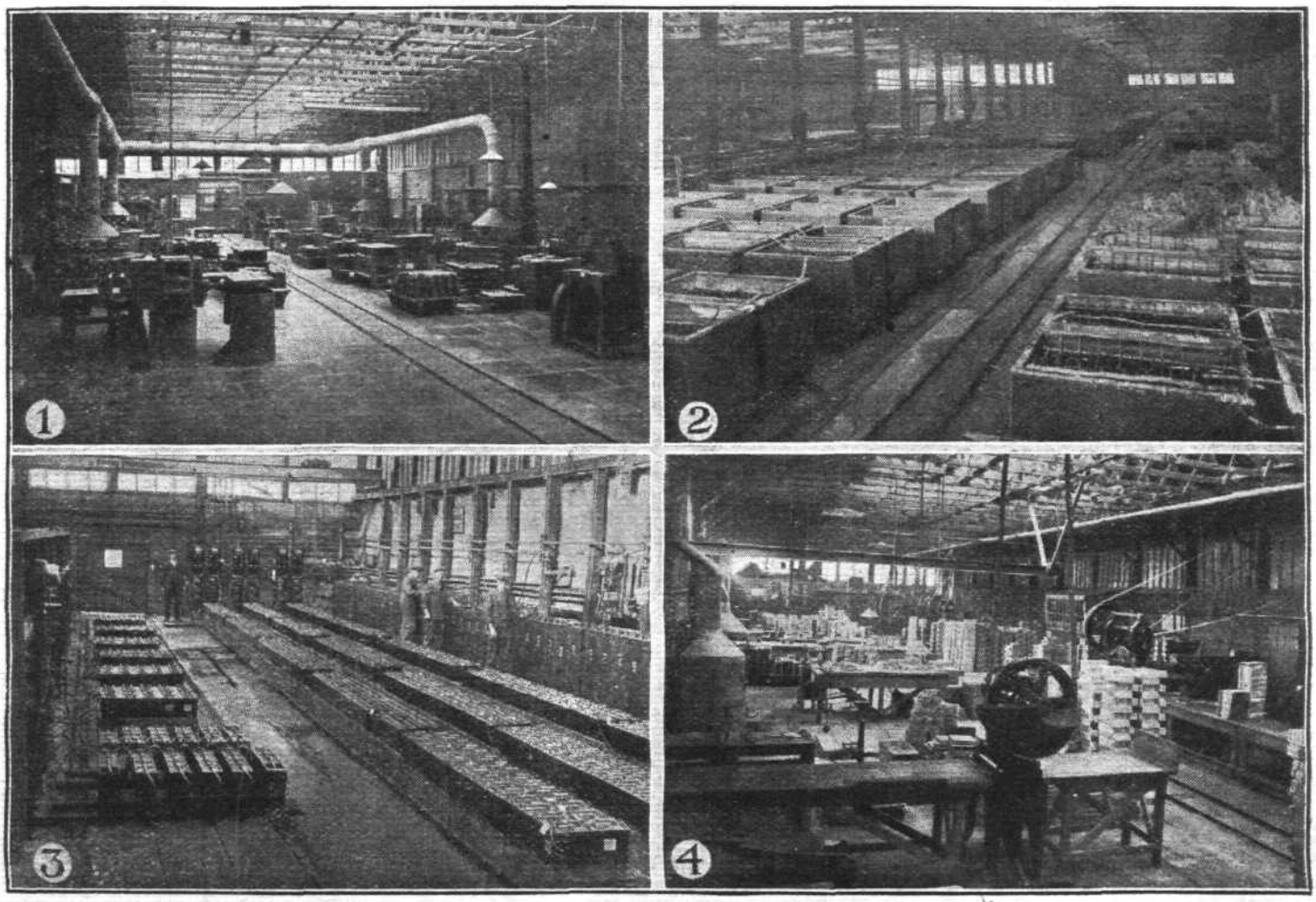
Though well known to motorists as the manufacturers of the world-famed "Exide" batteries for car lighting and starting, the firm in question is equally famous for its similar productions as designed for many other specific purposes, such, for instance, as municipal power station, train lighting, electric road-vehicle propulsion, country house lighting plants, and portable lamps generally. In fact, the manufacture of accumulators from those weighing approximately half-a-ton, and ranging downward to others scaling but a few ounces, and of various types, according to purpose, is the staple, and, indeed, the sole sphere of activity of this firm.

Recently we paid a visit to the factory at Clifton Junction with the main object of seeing for ourselves something of the scope of the work on which it is engaged, and the different processes entailed in the manufacture of its products. We must confess to the visit having been educative as well as merely interesting, the former not only by reason of the knowledge we gained of the firm's wide activities—since the making of ignition batteries is, comparatively speaking, an insignificant proportion of the total—but also by reason of the vast amount of work and care involved in the making of even such a commonplace and apparently simple object as an accumulator.

Established here in 1893 as a comparatively small undertaking, the factory has grown year by year until at the present time it covers a total ground area of over 10 acres, and additional sheds are still in course of erection. From almost the first, it has been practically self-contained; that is to say, it has itself produced all but the raw material entering into the make-up of the finished article, such substances as glass and ebonite, of course, being in this case regarded as raw material.

Such was the excellence of the work produced, that it was not long before the Exide type cells were being supplied to the Admiralty for use on submarines, and from that time until the outbreak of war the firm enjoyed a virtual monopoly in the provision of accumulators for this purpose, a monopoly which was only broken for reasons of national safety, which would otherwise have been endangered in the event of damage or destruction of the works by enemy aircraft. Even so, we are given to understand, those accumulators made by other firms were produced from the drawings and formulæ of the Chloride Co., and were therefore "Exide" batteries in all but the place of birth. A unique unsolicited testimonial as to the satisfactoriness of the batteries under active service conditions has been received from the Naval authorities directly concerned with the submarine branch of the service.

As already mentioned, different purposes require different type batteries, and those produced by this firm may be divided primarily into the following types: the Chloride, the Exide, the Armoured and the Clifton, each of which is also capable of subdivision. Briefly, and within the elastic limits of accuracy, the purpose of each type may be formulated thus: Chloride type for large stationary lighting and power installations, where weight is no object; Exide type for portable purposes when weight has to be considered, and comparatively low internal resista ce is necessary, coupled with high efficiency, such as is particularly requisite for engine starting of cars; Armoured type for electric vehicles, especially heavy commercial lorries subjected to rough



Interior views of some of the sheds in the factory of the Chloride Electrical Storage Co., Ltd.: 1, The Exide moulding-sheds, where grids for this type of battery are turned out; 2, The forming-shed, in which the plates or groups of plates are "formed," *i.e.*, their paste converted to active material by subjecting the plates to a prolonged charging before being made up into the cells; 3, The charging-shed: note the huge batteries to the right against the wall, and the overhead travelling crane used for their local transportation; 4, The general moulding-shed

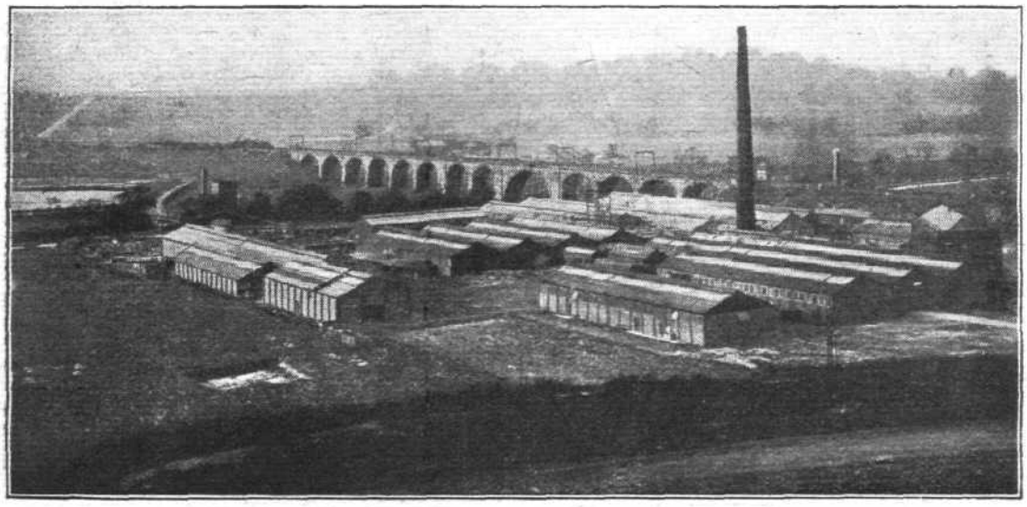
usage, severe vibration and shocks, where robustness counts for most—even at the expense of area of the active part of the electrodes—while having due regard to weight considerations; and the Clifton type for small lighting and ignition plants, where robustness is not a *sine quâ non* and initial expense has to be considered.

One of the features of the Exide battery is the form of grid employed for both positive and negative plates. It is such that a series of absolutely unbroken vertical columns of active material lead to the "strap" to which the terminal lugs are attached, such material being red lead paste, subsequently converted to peroxide of lead when the cells are "formed," in the case of the positive plate, and litharge paste, similarly converted to spongy lead, for the negative plate. Other particular features are the use of separators of wood between the plates, and of a special lead alloy for the grids.

For use in connection with aeroplane engines, too, these batteries are made in an unspillable sub-type, the design of which permits them to assume a directly inverted position, or be subjected to any conceivable shaking, without the least fear of the electrolyte leaking, while at the same time allowing egress to the gases generated. For aviation purposes these are, generally speaking, supplied in celluloid cases, whereas for car work the cases are, as a rule, of ebonite. For every purpose, however, they can (at least in the larger sizes) be had with either celluloid or ebonite cases, as preferred. It is impossible for us, however, in the space at our disposal, to deal fully with all the improvements which have been embodied in accumulators made by this firm; suffice it to say that an active life of five years for the Exide type for car use, even when used in conjunction with electric starters, is not an unreasonable estimate, while at least three years' service under such conditions can be, and is, guaranteed, with no other attention than refilling with distilled water as evaporation takes place, and the proper cleaning attention to the terminals, etc. But even in the latter respect the need for attention is reduced to a minimum, since solid, undetachable lead connections unite the opposite poles of adjacent cells, though the detachable kind are provided if desired.

A word or two must be said regarding the factory and personnel. In the first place, unlike the majority of such establishments, a high sense of orderly arrangement prevails throughout, and the system by which each process in the making of each part, from the raw material onwards, is progressively carried out; while the part itself gradually moves forward after inspection to meet its coadjutants, thence the various parts being assembled—still in the same "chain" fashion, from hand to hand and shed to shed—to form the whole; finally passing to the "forming" and testing of the finished article, is the very essence of modern industrial evolution in mass production.

In the second place it is obvious that beyond the highly developed organisation the more human aspects have not been overlooked by the management. This is in particular noticeable in regard to all that promotes the health, comfort and well-being generally of the workers, for not only are the usual auxiliaries of canteens and such-like provided, but the cleanliness, ventilation and lighting of the various sheds seem all that could be desired. Further, a weekly medical examination is given to all those workers who, by reason of the nature of their employment, are subjected to danger from lead contamination; and on the first sign of this appearing in the case of any worker, he or she is transferred to other work until recovery is complete. It is doubtless for reasons such as these that a minimum of labour-troubles as well as a remarkably clean bill of health is enjoyed by the firm. The former is also guaranteed by the thorough understanding that appears to exist between the labour and the executive staffs, and to the personal interest each seems to take in the success of the whole.



Where Exide batteries are made: A general view of the works at Clifton Junction, near Manchester

SIDE-WINDS

It is proposed that the Handley Page Air Mail Services in India will be flown almost entirely by night, in order to economise, and when it is proved that there is a sufficient demand for through passenger accommodation on the mail services, it will be a perfectly simple matter to fit up machines with through sleeping berths, in which the passenger can retire to rest early in the evening to wake up to find himself several hundred miles from his starting point. The business man flying in these machines during the day need not waste his time, for they are equipped with wireless telephones and telegraph, and, if there is a demand for one, a stenographer will be carried on board. It is claimed that the Handley Page machines are especially suitable for flying in India, owing to the fact that the windows in the cabin are made to open, so that the cabin temperature can be regulated. This will prove to be a tremendous comfort in India, where the variation in temperature, due to change in elevation, is so great and rapid.

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WE understand from Messrs. S. Smith and Sons (M.A.), Ltd., that a large number of K.L.G. aero type sparking-plugs have been sold by the Disposal Board, and they wish to make it clear that these plugs are, of course, suitable only for use in aviation engines, and are not satisfactory in the average pleasure-car engine. There is a K.L.G. plug manufactured and offered by them, for every purpose, and they would be pleased to advise intending users of these plugs if they have any doubt as to the particular plug suitable for their own requirements.

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THE result of the Paris–Nice trials revealed a remarkable score for Wakefield Castrol, every class, as well as the 12 special awards, being won by riders who were using this famous lubricant.

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ERITH'S ENGINEERING CO., LTD., have now removed to 83, Kingsway, W.C. 2, and their new telephone number is Gerrard 1106.

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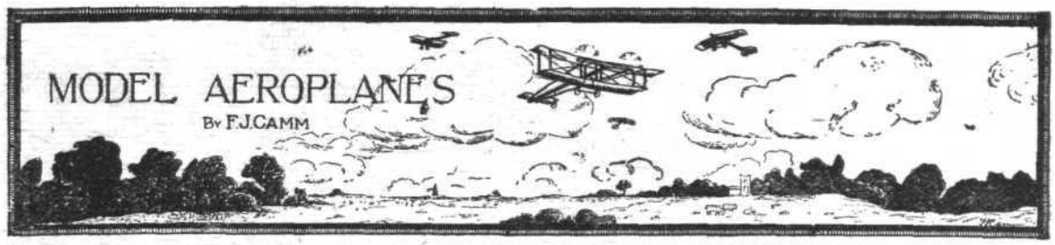
MRS. ALICE WATERS, of 44, Portsdown Road, Maida Vale, London, has been awarded the £1,000 prize offered by Messrs. J. P. Holland, Ltd., Walton House, Newman Street, W. 1, for the best condensed wording of a paragraph relating to the successes of the Rolls-Royce aero engines.

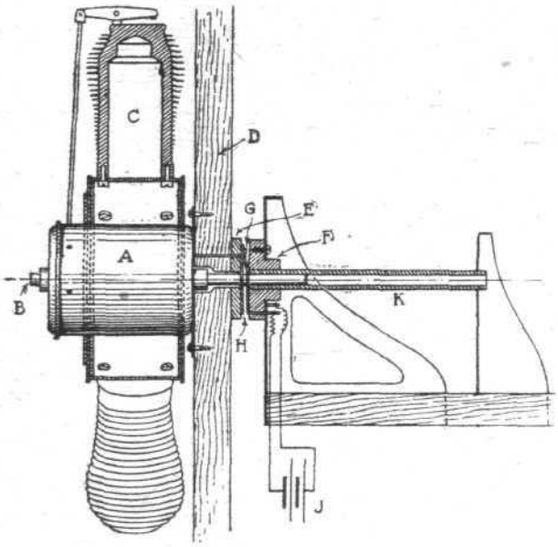
FLIGHT



NOTE.—*All communications should be addressed to the Model Editor.*

Electric Engine for Scale Models

I SHOW herewith a design for an electrically driven rotary motor for scale and show models. In the figure, A represents the case of the electric motor, B the armature shaft, and C the cylinder. The latter may be of any suitable metal fit for show purposes. An imitation crank-case is made to fit over the motor casing and so carry the seven cylinders,

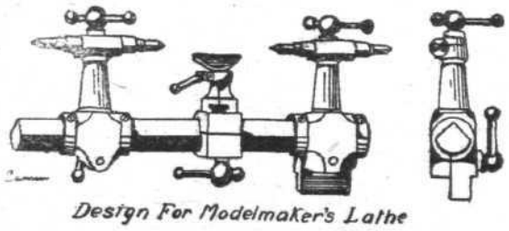


SECTION OF MODEL GNOME (ELECTRIC) MOTOR

thick tin-plate will do for this. It will be necessary to make the crank-case and fix the cylinders in position before attaching the electric motor, since the screws holding the cylinders are fixed from inside the crank-case. The propeller is shown by D, and is fixed by screws to a small plate fastened on the end of the motor; through it passes *via* two holes, the wires from the motor terminals. The commutator discs should be of red fibre, and are shown by E and F.

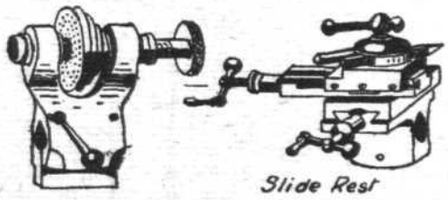
A Model-Maker's Lathe

The illustrations show a simple form of lathe or "turns" that can easily be made at home, and is suitable for making compressed-air motors and small turned parts for model



Design For Modelmaker's Lathe

aeroplanes. The bed is of extruded section, being filed to that form from a piece of bright drawn mild steel shaft of ¾-in. diameter. This is sufficiently accurate to be used



Slide Rest

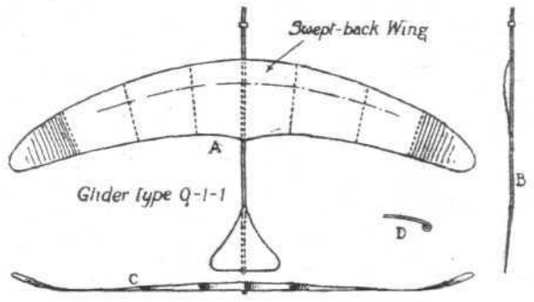
without further machining. The headstock and tailstock or poppet head are brass castings sufficiently high to admit 2-in. diameter stock 6 ins. long between centres. They should first be made in wood, with prints pinned on each end, and then submitted to the foundry. The holes for the bed will then be cored out by them. The hand-rest is merely socketed into a split block locked friction-tight upon the bed. As will be seen, the lathe is intended for use in the vice. An auxiliary headstock with cone pulley and dividing plate (the latter for wheel-cutting and fluting) is shown with an emery wheel capable of small grinding and lapping, while the small slide-rest shown in the further illustration will be useful for compound turning. I have intentionally shown the drawings in patch black style, as it would seem from correspondence that such style conveys more to the man not versed in workshop drawings. I should be pleased, however, to show scale drawings of the lathe, should a general desire for them be manifest.

Rubber and Lubricant

To preserve the elastic of a model aeroplane, it must be kept in a dark place when not in use. A good lubricant may be made by emulsifying 2 ozs. of soft soap (pure) in ½ pint of water, bringing slowly to the boil. A small quantity of salicylic acid should be sprinkled in to kill any of the substances in the soap likely to prove deleterious to the rubber. Before putting the rubber away, it should be washed in a weak soda-water solution and dried in a cotton swab. The life of a rubber motor cannot be defined. It depends, primarily, on the quality of the rubber, and secondarily on the number of strands, the number of turns given, the cross-section, length of skein, etc. But from data obtained by the writer, with careful use, a rubber motor should last at least 60 flights. Elastic, ¼ in. by $\frac{1}{32}$ in., is the most suitable section to employ. New rubber should not be wound fully, the result of so doing being "split" edges to the strands. The full number should be gradually approached.

An Efficient Glider

In the accompanying sketch a neat and efficient paper glider, with which some hundreds of glides over 50 ft. long have been made, is seen. The plane is cambered where shown dotted, and is made from 30 S.W.G. piano wire. An



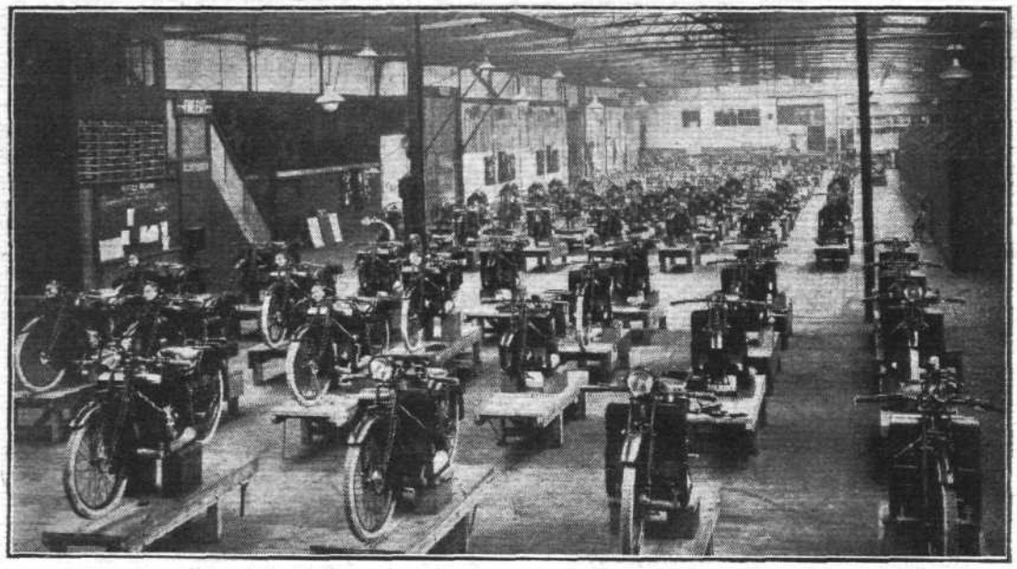
AN EFFICIENT GLIDER

adjustable weight, which slides by friction along the main spar, is used to adjust the centres of pressure and gravity. A is a plan view, B a side elevation, and C an end elevation, D being a detail of the rib joint with the plane edges. Notice that the plane has negative tips.

Answers to Correspondents

J. C. H. G. (CANTON).—Stretch the silk from end to end and secure with drawing-pins partially pressed home until the glue has set. Small quantities of Cellon dope can be obtained from Messrs. A. E. Jones, 52, High Street, New Oxford Street, this would tauten it. Or varnish diluted with turpentine would suit.

R. H. B. (WOOD GREEN).—You could hardly do better than work to the drawings which appeared in FLIGHT of July 17 last. The particulars there given should enable you to make a good scale model of the Vickers-Vimy. If you still find any difficulty you should visit the Science Museum and see the Transatlantic machine on view there.



Alert and alive as ever, the Sopwith Aviation and Engineering Co., Ltd., of Kingston, when at the conclusion of hostilities Government aircraft orders dropped off, turned their immediate attention to the next best thing to keep their stupendous establishment going, to act as a flywheel for their energies until such time as civil flying should have grown to proportions commensurate with those of military aviation. This energy took the form of devoting a portion of their plant to the making of the A.B.C. motor bicycle, and the accompanying photograph, a portion of the Sopwith erecting shop, shows in a very graphic manner the progress that has already been made in this direction. It is to be noted that it is not intended that the Sopwith company's activities in connection with the manufacture of motor cycles shall in any way interfere with the aviation side of its business, to which its energies naturally are primarily devoted

COMPANY MATTERS

The Aircraft Manufacturing Co., Ltd.

IT is announced that arrangements have been completed for the amalgamation of the Aircraft Manufacturing Co., Ltd, with the Birmingham Small Arms Co., Ltd. It is not intended that the former company, of which Mr. G. Holt Thomas is the founder, chairman and managing director, shall disappear. Its identity will be wholly maintained, and the manufacture of Airco (De H.) aeroplanes will be continued as previously.

Vickers, Ltd.

THE directors of Vickers, Ltd., announce that the final dividends for 1919 of 2½ per cent. on the preferred 5 per cent. stock (less tax), 2½ per cent. on the 5 per cent. preference shares (less tax) and of 2½ per cent. on the cumulative preference shares (free of tax up to 6s. in the £), will be paid on March 25, 1920.

* * * *

An Aeroplane Machine Gun

BEFORE the Royal Commission on Awards to Inventors last week, Maj. George Hazelton, late of the R.A.F., entered a claim in respect of an invention for quickening the rate of fire of a Vickers machine-gun.

Sir Ernest Wild, K.C., for the claimant, said that the invention was mainly used on aeroplanes' machine-guns, and increased the rate of fire from 500 rounds per minute to 1,000 rounds per minute. The Government had ordered 50,000 sets, of which 27,000 had been supplied. Maj. Hazelton's device had been described as the most meritorious aerial gunnery invention during the War, and if an award were made on its merits he would be satisfied.

Maj. Hazelton said that on one occasion a rate of fire of 1,385 rounds per minute was obtained. Maj. Harold Balfour, R.A.F., who had brought down 15 German machines, said that the use of the gear in aerial fighting increased the chances of a pilot by 100 per cent.

Mr. Trevor Watson said that the Treasury admitted the invention, and they did not suggest that it was part of the claimant's duty to invent.

The decision of the Commission will be given later.

AERONAUTICAL PATENTS PUBLISHED

Abbreviations:—cyl. = cylinder; I.C = internal combustion; m. = motors

APPLIED FOR IN 1918

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

Published March 4, 1920

16,003. F. H. PAGE. Elevator, etc., for aircraft control. (138,381.)

APPLIED FOR IN 1919

The numbers in brackets are those under which the Specifications will be printed and abridged, etc.

Published March 4, 1920

882. W. G. TARRANT. Aeroplane wings. (138,401.)
7,608. J. ROBERTSON. Rotary engines, etc. (138,481.)
7,897. J. H. KENNERLEY and A. AND E. DAVENPORT Rotary engines. (138,484.)

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